AEI Consultants

March 22, 2018

CORRECTIVE MEASURES IMPLEMENTATION WORK PLAN:
Soil Remedy for Former Production Area (Lot 1102)

Property Identification:

BASF Former Ciba-Geigy Facility
180 Mill Street
Cranston, Rhode Island

AEI Project No. 363655

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1.0 BACKGROUND

On May 29, 2016 EPA issued a draft Statement of Basis (SOB) for the Former Ciba-Geigy Site at 180 Mill St, Cranston, RI (RCRA Site) for public review and comment. The purpose for the SOB is to present what EPA considers to be the most feasible remedial alternative (i.e., the remedy) to achieve Resource Conservation and Control Act (RCRA) Site closure, and to provide a summary of the data and information used to support remedy selection. This background information includes a description of RCRA Site use history, remedial investigation data gathering, and past remedial actions.

The public review and comment process was initiated by a public meeting held on June 15, 2016. The purpose for public review and comment is for the EPA to compile, consider and address, as practical, all remedy-related stakeholder and interested party issues and expectations. Stakeholders include the Rhode Island Department of Environmental Management (RIDEM) and the City of Cranston, as well as, BASF Corporation, which is responsible for implementing the remedial actions. Interested parties include the general public, adjacent neighbors, and non-governmental organizations.

The May 29, 2016 draft SOB and the June 15, 2016 public meeting presentation are available on the EPA's RCRA Site-dedicated web page: https://semspub.epa.gov/src/collection/01/AR64497.

The corrective action proposed by the EPA in the draft SOB is summarized as follows:

Objectives are to protect human health and the environment by:

a. reducing the potential for direct contact to impacted soil, groundwater and sediment media and
b. reducing the potential for migration of Site-related impact in groundwater and surface water.

The draft SOB considers all aspects of the RCRA Corrective action. As presented in the SOB, there are three areas that make up the RCRA Site: (1) the Office, Warehouse and Laboratory area (OWLA), (2) the former Waste Water Treatment Plant Area (FWTPA), and (3) the Former Production Area (FPA). The OWLA, also referred to as Lots 111, 112, 114, 1108 and 2630, was addressed in a separate Remedial Action Work Plan (AEI 2017d and RIDEM approval letter October 16, 2017). The FWTPA did not require additional remedial action beyond that which had already been implemented.

The FPA, also referred to as Lot 1102, was found to require remedial action for soil, groundwater and sediment impacts. The compounds of concern are polychlorinated biphenyls (PCB) and

volatile organic compounds (VOC). To meet the remedial objectives, and to meet EPA's RCRA and Toxic Substances Control Act (TSCA) requirements and the RIDEM's Remedial Regulations, the remedy presented in the draft SOB associated with the FPA parcel, included the following elements for each affected medium:

Soil:

1. Removal and off-site disposal of all soil impacted with polychlorinated biphenyls (PCB) greater than or equal to 10 mg/kg. Verify that this metric is achieved by implementing an EPA-approved post-excavation verification sampling plan.
2. For remaining in-place soil that is impacted by PCBs above 1 mg/kg, cover with two feet of certified-clean soil, as per RIDEM regulations.
3. At a minimum, Lot 1102 will be landscaped and vegetated to support native upland habitat and a long-term maintenance plan will be implemented to maintain the vegetated soil cover. The remedy is intended to allow for the potential for future Lot use as a publicly-available open space.

Groundwater:

1. Restoration. In the southwest part of Lot 1102 use a combination of physical removal (excavation), in-situ chemical oxidation (ISCO), and natural processes to reduce upland groundwater volatile organic compound (VOC) impacts to site-specific and RIDEM cleanup standards.
2. Migration control. Employ ISCO technology (ozone reactive wall) to reduce or eliminate site-related VOC-impacted groundwater from discharging into the Pawtuxet River. A pilot test will be conducted to develop the necessary design and operation parameters.
3. Monitoring and Maintenance: Employ a long-term monitoring and maintenance plan, subject to EPA and RIDEM oversight, to verify that the objectives are being met.

Sediment:

1. A sediment remedy has been in place since 1996, and it included excavation followed by capping with clean sand. To meet the current corrective action objectives, periodically monitor that the sand cap is functioning as intended, i.e., as a physical barrier and as a limiter to residual impact migration.

Finally, to ensure that the corrective measures are maintained over time, a RIDEM-approved and TSCA compliant Environmental Land Use Restriction (ELUR) will be imposed on Lot 1102, specifying, at a minimum, the following:

1. Property reuse as open space only.
2. No residential use allowed except as may be approved by the Department as a Recreational Facility for Public Use under the RIDEM remedial regulations.
3. No groundwater uses except as required for remedy monitoring.
4. Operation and maintenance of the surface cover areas and vegetative support as per an EPA-approved O&M plan.
5. Annual reporting to the RIDEM for ELUR compliance.
6. No invasive work below the covered areas is allowed without implementing a RIDEM-approved soil and groundwater management plan and clean soil cover integrity plan (e.g., as may be required for utility maintenance).

Through October 2017, the EPA has received the following comments related to Lot 1102 as part of the public review and comment process:

1. General public: The main comments related to the feasibility of removing the proposed soil quantities from the property and replacing it with clean soil and the truck traffic that the project would generate on the residential streets between the property and the highway, with an elementary school along the way. Specifically, the question was posed whether there is a way to limit the number of trucks and their frequency during school hours.

2. BASF: BASF commented on the feasibility of uniformly removing all PCB-impacted soil greater than 10 mg/kg. Specifically, based on the results of the soil IRM completed in 1995, and subsequent sampling through the 2016 RCRA Site investigation, it is apparent to BASF that the presence of subsurface infrastructure (concrete slabs and foundations) will impede if not limit BASF's ability to achieve the 10 mg/kg remediation goal described in the SOB.

3. RIDEM: RIDEM commented on the fact that its Remedial Regulations require, as a default, that to consider Lot 1102 for future use as a potential recreational facility for public use, and to protect the groundwater resource, the residual PCB content in soil must be less than or equal to 10 mg/kg, but that site-specific remedial objectives may be considered given EPA concurrence.

To address these perceived important considerations, while meeting the remedy objectives, i.e., limit direct contact and mobility metrics while meeting TSCA and RIDEM regulations, **BASF proposed to the EPA and RIDEM the following modifications to the soil remedy presented in the draft SOB on Lot 1102:**

1. Removal and off-site disposal, at an approved facility, of all soil impacted with PCB greater than or equal to 25 mg/kg, and, as necessary, additional soil with PCB content greater than or equal to 10 mg/kg, such that the resulting Exposure Point Concentration, as calculated by the 95% Upper Confidence Level, is less than 10 mg/kg. This condition will be verified by implementing a TSCA-approved post-excavation verification sampling plan. This modification reduces off-site disposal requirements by an estimated 60%.
2. Within the FEMA Floodway, because capping and elevation increases are not permitted according to FEMA regulations, PCB-impacted soils ≥1 mg/kg will be removed and replaced with clean soil. Similarly, this < 1 mg/kg PCB condition will be verified by implementing a TSCA-approved post-excavation verification sampling plan.
3. After excavation is complete install a "clean soil cover" that encompasses all areas with in-situ soils containing PCBs >= 1 mg/kg, defined as follows (listed from cover bottom to top):
   a. To limit the leaching potential of remaining soils containing >=10 mg/kg PCBs and subject to infiltration from precipitation, cover subject soils with an impermeable high-density polyethylene (HDPE) cover material.
   b. To limit unapproved invasive activity and access to in-situ soils and to function as a cover boundary indicator, cover the entire area (except the sewer easement) with a permeable geotextile barrier.
   c. To further limit the potential for direct contact of in-situ soils, apply a layer of 2-ft clean soil or equivalent (e.g., crushed stone may be used in areas where 2-feet of soil cannot be placed due to flood storage considerations, as in Floodway Zone AE per federal regulations, to support landscaping alternatives, and as an additional engineered impediment to potential future unapproved invasive activity) over the entire area.

   These three combined elements, impermeable cover material, geotextile barrier and soil cover are referred to as a "clean soil cover" in this document.
4. The surface of the subject property (Lot 1102) will be landscaped and vegetated to support native upland habitat.
5. The PCB soil removal and clean soil cover eliminate the need for warning signage, because no soils containing >25 mg/kg PCBs will remain. Therefore, no signage will be installed along the periphery of the property after implementation of the remedy.
6. At a minimum, fencing will be installed along the river reach to limit river access, e.g., as a safety precaution. A security fence around the property is not proposed, though some form of fence demarcating the property boundary will be installed.
7. A long-term clean soil cover operation and maintenance plan will be developed for Agency review and implemented.
8. The remedial plan described above is intended to meet both TSCA and RIDEM Remedial Regulations, function as an impediment to unauthorized invasive activity and limit impact to groundwater considerations. In addition, at a minimum, the clean soil cover will provide

a substrate to support an enhanced upland habitat vegetation landscaping scheme. Finally, the remedy is intended to allow for potential future use of Lot 1102 as open space and parking, as will be defined in an ELUR to be filed with the property deed.

9. A PCB deed notice, required for any area where PCBs remain at ≥1 mg/kg, and an environmental land usage restriction required by the RIDEM and EPA, will be entered into as a joint document, if possible, and will be recorded on the deed as required by the EPA TSCA program and the RIDEM.

BASF is proposing this modified remedial design for the soil component of the remedy under a risk-based approach in accordance with the Toxic Substances Control Act (TSCA), 40 CFR 761.61 (c) and RIDEM Remedial Regulations.

2.0 INTRODUCTION

Given this background information, the following Corrective Measures Implementation (CMI) Work Plan (WP) has been prepared for the BASF Facility, formerly owned by Ciba-Geigy, located at 180 Mill Street, Cranston, Rhode Island. **Specifically, this CMI WP proposes remedial actions for the soil component of the remedy associated with the FPA, designated as Lot 1102 (herein referred to as the "Site").** The groundwater and sediment cleanup objectives are discussed in this document, but further remedial design details for groundwater will be provided in a separate CMI WP, to be submitted to EPA and RIDEM for review and approval. A sediment Operation and Maintenance Plan is presented in this document.

The CMI WP details the remedial design for the Site that is outlined in Section 1. The design is based on the Corrective Measures Study (CMS) completed by BASF in June 2016 and approved by the (EPA) in April 2016 (AECOM, 2016a), the EPA's Draft SOB for the Proposed Remedy Determination dated May 25, 2016 (EPA, 2016), included as **Attachment 1**, all the investigations completed to date at the Former Ciba-Geigy Facility in accordance with the Resource Conservation and Recovery Act (RCRA) Corrective Action Program (RCRA Docket No. 188-1088, EPA ID No. RID001194323), consideration of public comment and scientific rationale, and the results of a human health risk evaluation.

Specifically, BASF is seeking approval from the EPA and the RIDEM for this remedial design for soil under a risk-based approach in accordance with the Toxic Substances Control Act (TSCA), 40 CFR 761.61 (c) and RIDEM's Remediation Regulations, DEM-DSR-01-93.

This design is intended to meet the following remedial action objectives:

a. eliminate direct contact to impacted soil and groundwater; and

b. eliminate contaminant of concern migration: PCBs in soil and groundwater, VOCs in groundwater.

To meet these objectives, a risk-based remedial approach under TSCA is proposed, as outlined in Section 1. Given the results from a human health risk evaluation (see **Section 3.3.9**, **Appendix C** and **Appendix D**), the use of 2-foot clean soil cover with an impervious cover material over residual PCB concentrations greater than or equal to 10 mg/kg (as needed), the use of a 2-foot clean soil cover and geotextile material over contaminated soil with less than 10 mg/kg PCBs, and the imposition of an ELUR on the Site, the remedy will meet both EPA TSCA rules [40 CFR 761.61 (c)] and DEM Remediation Regulations (DEM-DSR-01-93).

This CMI is specific to the soil remedial action. Groundwater and sediment cleanup objectives are discussed in this document, but further remedial design details will be provided in a separate CMI WP for groundwater to be submitted to EPA and RIDEM for review and approval. A remedy to address sediments was previously implemented, however, in accordance with the SOB, a monitoring plan for sediments in the Pawtuxet River is included in this document in **Section 6.2**.

This present document has been prepared in accordance with the EPA RCRA Corrective Measures Implementation Scope of Work guidance document (USEPA, 2011), which consists of four tasks:

- Task I: CMI Work Plan
- Task II: Corrective Measures Design
- Task III: Corrective Measures Construction
- Task IV: Reports.

Each of these task items will be discussed further in this document. The intent of this CMI WP (Task 1) is to obtain EPA and RIDEM approval of the alternative risk-based remedial approach, so that BASF can proceed to implement the proposed remedial actions.

2.1 Purpose and Objectives

This document is specific to the remedial design for Lot 1102 (Site). **Figure 1** shows a survey map based on ALTA, property, and field surveying data, that depicts the Site outlined with a bold dashed line. **Figure 2** graphically depicts the Site area and existing features.

While the overall proposed corrective action will include both soil and groundwater remedial actions, the focus of this document is on the soil remediation component. A separate CMI will be prepared for the groundwater remediation component, once results are obtained from the proposed in-situ chemical oxidation (ISCO) pilot programs, the work plans for which will be submitted under separate cover. This dual approach allows PCB contamination present in shallow

soils to be removed within the next twelve (12) months, while the full groundwater remedy proceeds in parallel over a longer period of time.

Consistent with the Project Scoping Documents, the Proposed Remedial Actions for the Site are described as follows:

Soil

Removal Actions

- Removal and off-site disposal, at an approved facility, of all soil impacted with PCB greater than or equal to 25 mg/kg, and, as necessary, additional soil with PCB content greater than or equal to 10 mg/kg, such that the resulting Exposure Point Concentration, as calculated by the 95% Upper Confidence Level, is less than 10 mg/kg.
- For the Floodway Area (**Figure 2**) along the river margin, which will not be covered in the manner described in the Final Remedial Activities below, PCB-impacted soils with concentrations greater than or equal to 1 mg/kg will be removed, and the excavations backfilled with clean backfill materials to existing grade, or lower. Wetland soil type and vegetative species will be installed in portions of the Floodway Area.
- Implement a TSCA approvable post-excavation verification sampling plan to verify that the cleanup metrics are achieved.

Final Remedial Activities

- After the removal actions described above are complete, install a 2-ft clean soil cover over all areas where greater than or equal to 1 mg/kg PCBs remains to limit both direct contact and leaching potential. The clean soil cover will include an impermeable high-density polyethylene (HDPE) cover material (e.g. Nilex 40 mil HDPE, or equivalent) over areas where intervening concrete slabs are not present for leaching control, and the entire area (except for the sewer easement) will be covered by a permeable geotextile barrier (e.g., Mirafi 180N or equivalent). Once placed, the HDPE cover material will function as an impediment to water infiltration and the geotextile barrier will act as an impediment/indicator to unapproved invasive activity. The geotextile material will be covered with 2-feet of certified clean soil or equivalent (e.g., crushed stone may be used in areas where 2-feet of soil cannot be placed due to flood storage considerations, as in Floodway Zone AE (see **Figure 2**) per Federal Emergency Management Agency (FEMA) and RIDEM Wetland regulations, to support landscaping alternatives, and as an additional engineered impediment to potential future unapproved invasive activity). This clean soil cover configuration will eliminate the risk to humans of direct contact with impacted soil and limit the potential for dissolved-phase migration and thereby meet the requirements for an alternative TSCA risk-based closure under 40 CFR Part 761.61 (c) and RIDEM Remedial Regulations.

- The surface of the Site will be landscaped and vegetated to support a native upland habitat, and because the Site exceeds 1 acre in size this application will meet state/federal Storm Water pollution prevention and erosion control regulations in FEMA Zones AE and Zone X (**Figure 2**).
- The resulting removal and Site restoration will not require the need for warning signage per RIDEM and/or EPA TSCA regulations per 761.61(a)(4) since the PCB levels remaining at the site will contain < 25 mg/kg PCBs. Therefore, no warning signage will be installed along the periphery of the Site after implementation of the remedy.
- At a minimum, fencing will be installed along the river reach to limit river access (e.g., as a safety precaution given the ten-foot drop between ground surface and the water). A security fence around the property is not proposed, though some form of fence demarcating the FPA property boundary will be installed.
- Develop and adhere to a long-term soil management and cover maintenance plan for EPA and RIDEM review.

Groundwater

Details of groundwater-related pilot study and full-scale work plans will be submitted under separate cover.

- Employ ISCO and monitored natural attenuation (MNA) technologies to reduce upland groundwater VOC impacts to meet site-specific and RIDEM GB standards.
- Employ ISCO technology (ozone reactive wall) to reduce or eliminate site-related VOC-impacted groundwater from discharging into the Pawtuxet River, in the southwest corner of the FPA. This will address all VOC mobility considerations.
- While the ozone system is operating in the southwest corner of the property, estimated 3 to 5 years, it will be locally isolated with the installation of a security fence and signage.
- Monitoring wells will be present across the property until such time as groundwater meets applicable regulatory metrics. Unauthorized access to groundwater monitoring wells will be limited by locking, as appropriate.
- Develop and implement a groundwater operation and maintenance plan.

Environmental Land Use Restriction (ELUR)

An ELUR will be imposed on the Site specifying, at a minimum, the following:

- No residential use is allowed except as may be approved by RIDEM as a Recreational Facility for Public Use, or as Open Space under its remedial regulations.
- No groundwater use except as required for remedy monitoring (groundwater is currently classified as GB).

- Operation and maintenance of the clean soil cover and vegetative support as per an EPA-approved Operation and Maintenance (O&M) plan.
- Annual reporting to the RIDEM for ELUR compliance.
- No invasive work below the clean soil covered areas is allowed without implementing a RIDEM approved soil management plan (SMP) and soil cover integrity plan (e.g., as may be required for utility maintenance).

2.2 Work Plan Overview

The following CMI is divided into the following sections:

- Section 3.0 describes the history of the Site, previous investigations and remedial efforts conducted on the Site, describes hydrogeology, and presents the final approved cleanup standards for the Site.
- Section 4.0 summarizes the design of the soil removal program and discusses the ISCO groundwater remedy.
- Section 5.0 describes the required construction-related plans, including permitting requirements, preconstruction plans, construction quality assurance plan and health and safety plan (HASP).
- Section 6.0 presents the operation, monitoring, inspection and maintenance plan
- Section 7.0 presents the project schedule and reporting requirements.
- Section 8.0 presents the references cited in this work plan.
- Figures, tables and appendices follow Section 8.0.

2.3 Program Management

The purpose of the management plan is to document the overall management strategy from design through close-out and long-term monitoring of the corrective measures. The corrective measures for the Site will be implemented under the supervision of BASF. Dr. Joseph Guarnaccia, Ph.D., the BASF Project Manager, will have overall responsibility for implementation of the remedial program.

AEI Consultants (AEI) will serve as BASF's environmental consultant. In this capacity, AEI is authoring this Work Plan in collaboration with BASF, and it will oversee its implementation.

The project's contractor, to be selected, will be responsible for completing the remedial measures and compliance sampling detailed in the contract specifications, drawings and plans contained within this WP.

All groundwater-related work will be conducted in coordination with the soil excavation and covering activities.

3.0 SITE DESCRIPTION AND ENVIRONMENTAL ISSUES

3.1 Site History and Usage

The property associated with this CMI is a former chemical production facility operated by Ciba-Geigy from 1953 to 1986. The Alrose Chemical Company initiated chemical manufacturing on-Site in 1930. The Geigy Chemical Company of New York purchased the facility in 1954 and later merged with the Ciba Corporation in 1970. The facility was used for batch manufacturing of organic chemicals, such as plastic additives, optical brighteners, pharmaceuticals, and textile auxiliaries (Ciba Corporation, 1995). The Ciba-Geigy facility ceased all chemical manufacturing operations in May 1986 when the plant was closed and in 1986-1987 the production facility was demolished to grade under a demolition permit issued by the State of Rhode Island. Building foundations, a rail line, subsurface utilities and a retaining wall along the adjacent river were left in place. Subsurface utilities were capped at the River. All service lines (i.e., fire, gas, sewer and domestic water) were physically disconnected and capped at the Site boundary line. According to a historical discussion with facility personnel, broken concrete and bricks were used to fill basements and other void spaces (i.e., elevator pits, tunnels, etc.). All underground storage tanks (USTs) were removed, except one sanitary water concrete transfer tank (in the vicinity of former Building 14), which was historically noted as approximately 1,200 gallons.

The FPA consists of approximately 3.25 acres bounded to the west by Mill Street (beyond which are industrial properties), to the north and east by a BASF-owned property which includes a former railroad spur (Lot 2630) beyond which are former Site buildings and residences, and to the south and east by the Pawtuxet River. Lot 1102 is zoned Industrial M-2. According to the City of Cranston Zoning Ordinance, Industrial M-2 districts are intended primarily for the use of general industry.

3.2 Geologic and Hydrogeologic Setting

Site soils are generally comprised of medium to coarse silty sands and gravels within the top six to eight feet. Underlain are dense silts and fine silty sand lenses (ranging from 10 to 15 feet thick). Below these soils are a layer of glacial till (ranging from 5 to 10 feet thick). Bedrock has been noted at depths ranging from 30 to 90 feet below grade surface (bgs). Refer to **Figures 2A and 2B** in **Appendix C** for illustrative cross-sections.

Shallow and deeper groundwater flow direction is generally to the southeast toward the Pawtuxet River (see **Figures 3A** through **3D** in **Appendix C**). These Figures include water table elevations (feet above mean sea level). The water table is historically reported to be at approximately 7 to 10.5 feet below the ground surface (bgs) across the FPA see **Figures 3A** and **3B in Appendix C**. Generally, the water table elevation has not shown any great variation due to seasonal

fluctuations (<1.5 feet for shallow and <2 feet for deep groundwater) [Ciba Corporation, 1995] over time. Similar elevations as noted during the 1995 RFI were reported in the 2016 Supplemental Remedial Investigation, or SRI (AECOM, 2016b). Site-related groundwater discharges to the Pawtuxet River, and flow is affected by a bulkhead wall (sheet piling) that extends to a depth of 25 feet bgs, where groundwater is deflected downward under the wall (and to the west) as it migrates toward the river (refer to **Figure 4 in Appendix C**).

3.3 Previous Investigations and Remedial Actions

Between 1990 and 2017, several environmental investigations and remedial efforts were conducted at the Site:

3.3.1 1990 to 1994 RCRA Facility Investigation [RFI] (Ciba Corporation, 1995)

The RFI was conducted at the property to characterize its physical nature, to identify the nature and extent of subsurface contamination releases, as well as to conduct a public health and environmental risk evaluation (PHERE) to determine if contamination posed an unacceptable risk to public health and the environment. According to the PHERE, the target risk levels (cancer risk of 10^{-4} and Hazard Index < 1) were exceeded, and a Site-specific Media Protection Standard (MPS) for PCBs in soil was set at 45 mg/kg.

Twenty-two shallow monitoring wells (MWs) were installed in the following identified Solid Waste Management Units (SWMU) and Areas of Concern (AOC): SWMU-2 (MW-10S, MW-10D), SWMU-7 (MW-12S, MW-12D), SWMU-8 (MW-13S), SWMU-11 (MW-4S, MW-14S, MW-20S, MW-21S), AOC-13 (MW-1S, MW-1D, MW-2S, MW-3S, MW-22S, MW-23S, MW-24S, MW-29S, MW-29D, MW-30S, MW-30D, MW31S, MW-31D) and one bedrock well (RW-1). Wells were sampled for a broad spectrum of compounds including VOC, SVOC, chlorinated dioxins/furans, PCB, metals, and herbicides/pesticides.

PCBs were detected twice in one monitoring well, MW-12S screened 6' to 16' feet bgs. Aroclor 1260 was detected at 22 and 30 ug/L in MW-12S located on the northern part of Lot 1102. No PCBs were detected in deep overburden or bedrock wells. VOCs were detected repeatedly in the shallow wells, except wells MW-5S (north end of FPA) and MW-10S, MW-20S, and MW-24S (north end of the process building area). VOCs detected most frequently in the shallow wells included chlorobenzene, ethylbenzene, xylenes and toluene.

One hundred and thirty-three (133) soil samples were collected from the shallow (less than or equal to 2 feet bgs) and deep (greater than 2 feet bgs) soils within the FPA. The highest levels of PCBs were found near the southern end of the FPA in shallow soils. However, only 25 of the 133 soil samples (19%) contained PCB concentrations greater than or equal to 25 mg/kg. VOCs

in shallow soils (0-2 feet bgs) detected xylenes and toluene. The highest detection of xylenes occurred in samples collected from SWMU-8 (400 mg/kg). The highest detections of toluene were observed from SWMU-11 (toluene = 1,200 mg/kg). Refer to **Figure 5 of Appendix C** for locations of the SWMUs. Deeper soils (greater than 2 feet bgs) also contained ethylbenzene, xylenes and toluene.

3.3.2 1995 Pawtuxet River Sediment RFI

Between 1995 and 1996, a RFI was conducted on the Pawtuxet River sediment. During this study, the compounds chlorobenzene, 1,2-dichlorobenzene, 2-chlorotoleune, toluene, and xylenes were identified as constituents of concern (COCs) in Site groundwater that could lead to impacts to the adjacent River. Therefore, groundwater MPS were developed for these compounds in the 1996 Pawtuxet River Corrective Measures Study (PTRL, 1996). These standards are based on exposure of benthic organisms in Pawtuxet River sediment to discharging site-related groundwater, where the river is the discharge point for site-related groundwater. The groundwater MPS, in conjunction with the current RIDEM GB groundwater standards, are the current basis for the Site groundwater treatment objectives.

3.3.3 1995 Interim Remedial Measure [IRM] (Woodward-Clyde, 1996)

Based on the 1990-1994 RFI data, an IRM was developed and completed in 1995 to address elevated levels of PCBs present in surface soil (less than 2 feet bgs) at the Site above the MPS of 45 mg/kg. Shallow soil containing total PCB concentrations greater than 45 mg/kg were removed in four phases from five Sub-Areas (labeled A thru E). Refer to **Figure 12 from Appendix C.** The remedial effort removed approximately 2,100 tons of PCB contaminated soils. Former building foundations and subsurface structures were left in place.

Over 146 post excavation soil samples were collected and analyzed for total PCBs. Ten samples contained PCBs above 45 mg/kg (see **Figure 4** for locations). According to Woodward-Clyde, the soils containing PCBs above 45 mg/kg were covered below a twelve-inch soil cover, which would be sufficient to address direct contact and/or exposure risk associated with current or future Site receptors.

According to the report prepared by Woodward-Clyde (1996), a minimum twelve-inch clean fill cover was used to restore the Site to grade. The cover was applied to the excavation areas, which encompassed about 27,600 square feet of the Site.

Refer to AECOM SRI (AECOM, 2016b) for further IRM details.

3.3.4 1996 Groundwater Treatment System (AECOM, 2016b)

As indicated in the 1995 RFI, groundwater concentrations for Site VOCs exceeded the groundwater MPS (see next subsection for MPS values). In response, a groundwater extraction and treatment system was installed to capture and treat groundwater prior to discharge to the river. In May 2006, the groundwater pumping system was turned off, with EPA approval, following groundwater monitoring that showed the MPS had been achieved. Follow up groundwater monitoring by Ciba, however, found the concentrations of chlorobenzene and 2-chlorotoluene had increased above the MPS in the southern portion of the Site. In 2008, a field investigation involving membrane interface probe (MIP) and soil/groundwater sampling was conducted to identify the nature and extent of the groundwater MPS exceedances. The results of the study were utilized to design pilot studies of two alternative technologies: air sparging and soil vapor extraction.

In April 2010, the groundwater pumping system was damaged in a significant flood event of the Pawtuxet River. In 2011, as part of an approved work plan, AECOM began air sparging and soil vapor extraction (SVE) pilot programs to evaluate the feasibility of both technologies to reduce Site groundwater VOCs below the MPS, allowing the groundwater pumping to be shut-down. Based upon their study's results, which are summarized in the 2014 Supplemental Remedial Investigation (SRI) report (AECOM 2016b), it was concluded that air sparging and soil vapor extraction could not achieve compliance with the groundwater MPS throughout the impacted aquifer volume. The reason for the limited effectiveness of this technology was due to low vertical conductivity related to anisotropy of the soil stratigraphy which caused the sparged air to disperse laterally rather than upward where it could be captured via vapor extraction.

3.3.5 1997 Soil Vapor Extraction [SVE]/Pre-Design Investigation [PDI], presented in final CMS (AECOM, 2016a)

A documented release of approximately 90 pounds of toluene from a pipeline in 1983 occurred near the western edge of Lot 1102. The spill area comprised SWMU-11, and a SVE system was installed in 1997 to address the resulting impact area. The SVE system removed toluene from shallow soil. The SVE system was operated from 1997 to 2005, when it was determined that it had reached its asymptotic end point and post-operation verification sampling showed that the groundwater MPS was achieved. Confirmatory soil samples in the SWMU-11 area were collected at and above the water table. A Post-SVE Soil Sampling Report was submitted to EPA in January 2005.

Pre-design investigation soil and groundwater data were collected by AECOM during September 2014 from areas downgradient of the shallow soil VOC impacts near SWMU-11 to investigate the current nature and extent of impact below the water table. Soil and groundwater were collected

from areas in the vicinity of former Building 16 on September 11 and 12, 2014. Undisturbed soil samples were collected from depths of 15 to 25 feet bgs via Geoprobe for laboratory analyses of VOCs. Groundwater was also collected from well MP-3I. Elevated concentrations of COCs, primarily toluene and 2-chlorotoluene, were identified in shallow and deep groundwater and in soil samples collected below the water table.

For soil below the water table, the highest concentration of toluene in soil was detected at a depth of 15-17.5 feet bgs (255 mg/kg), while the highest 2-chlorotoluene concentration was detected at 20-22.5 feet bgs (1,270 mg/kg).

Shallow groundwater (6-16 feet bgs) results indicated the following constituents above their MPS:

- 1,2-Dichlorobenzene: 1,500 ug/L (MPS = 94 ug/L)
- 2-Chlorotoluene: 20,600 ug/L (MPS = 1,500 ug/L)
- Chlorobenzene: 1,710 ug/L (MPS=1,700 ug/L)
- Toluene: 13,400 ug/L (MPS = 1,700 ug/L)
- Xylene (Total): 816 ug/L (MPS = 78 ug/L)

Deep groundwater (16 – 26 feet bgs) results indicated the following constituents above their MPS:

- 1,2-Dichlorobenzene: 4,560 ug/L (MPS = 94 ug/L)
- 2-Chlorotoluene: 41,000 ug/L (MPS = 1,500 ug/L)
- Benzene: 275 ug/L (RIDEM GB = 140 ug/L)
- Chlorobenzene: 14,100 ug/L (MPS=1,700 ug/L)
- Toluene: 59,500 ug/L (MPS = 1,700 ug/L)
- Xylene (Total): 3,510 ug/L (MPS = 78 ug/L)

These data are used to support design of the groundwater remedial actions identified in the CMS (AECOM, 2016) in the areas of SWMU-11 and Building 16 (see **Figure 16 from CMS**).

3.3.6 2014 Supplemental Remedial Investigation [SRI] (AECOM, 2016b)

The SRI evaluated PCB soil contamination and VOC impacts to shallow and deep groundwater. PCB soil evaluation occurred in three phases of work. The first two phases included 29 boring locations, which were advanced to 6 feet bgs and sampled for PCBs (samples designated as "SB"). The third phase involved the advancement of multiple borings in a 20-foot-center grid pattern throughout the FPA to a depth of 6 feet bgs. Samples were collected in specific intervals (0-0.5, 1-2, 2-4 and 4-6 feet) for analysis of PCBs via EPA Method 8082/3540. Overall, 335 data points are included in the SRI data set. The analytical results indicated that 13 samples were >50 mg/kg

(4%), 21 samples were >25 but <50 mg/kg (6%), 301 samples were <25 mg/kg (90%), 256 samples were <10 mg/kg (76%) and 45 samples were >10 mg/kg but <25 mg/kg (13%).

Eleven existing monitoring wells were sampled in June 2013 for PCBs via EPA Method 8082. Groundwater analytical results indicated PCBs were detected above the EPA Drinking Water Maximum Contaminant Level (MCL) of 0.5 ug/L in a well couplet: MP-3I (screened at 18-22 feet bgs) and MP-3S (screened at 5-13 feet bgs). MP-3I contained 9 ug/L of total PCBs, while MP-3S contained a total PCB concentration of 14 ug/L. This well couplet is located in the vicinity of an area historically known to contain high levels of PCBs in shallow soil. PCBs were not detected in groundwater in other parts of the upland portion of the property or in wells adjacent to the river. The wells sampled and a summary of the analytical results are shown on **Table 1** and **Figure 3**. A total of 51 groundwater samples were collected from 28 monitoring wells, 3 former extraction wells, and 10 temporary groundwater grab locations (GW-series), for VOC analysis during 2012 (AECOM, 2016b). The data were compared to the MPS. Based on results of the 2012 groundwater investigation, additional groundwater grab sampling and groundwater profiling activities were completed in July 2013, January 2014 and September 2014 to characterize the extent of Site COCs (chlorobenzene, 1,2-dichlorobenzene, 2-chlorotoleune, toluene, and xylenes). There were 10 samples where one or more groundwater MPS were exceeded from the groundwater samples collected in 2012.

To supplement the 2012 groundwater sampling effort, additional samples were collected in 2013/2014. These data, along with characterization of the Site's hydrogeology, were used to define the generalized shallow and deep groundwater impact zones with exceedances of either a site-specific MPS or a GB standard (see **Figure 20 in Appendix C**, which is reproduced from the AECOM CMS (AECOM, 2016a).

3.3.7 May 2016 Draft Statement of Basis (EPA, 2016)

See Section 1 above.

3.3.8 May 2017 Subsurface Investigation (AEI, 2017b)

To supplement the SRI PCB data and provide a final definition of soils which exhibited relatively high PCB impacts at depth, a test pitting program was conducted in the Spring of 2017. Twelve test pits were proposed: six of the test pits were located where PCBs were previously detected at concentrations greater than 50 mg/kg at the bottom of exploration and six were designated in "clean" (i.e., less than the 10 mg/kg metric) areas to observe subsurface conditions and confirm depth of historic backfill material. Sample results identified a "hot spot" area on the southern side of the property (at the location of TP-5) where PCB concentrations exceeded 100,000 mg/kg at a depth of 2-2.5 feet bgs. In the area of TP-5, a concentration of 4,500 mg/kg had been

detected at a depth of 0-2 feet bgs in sample B13045 prior to the IRM excavations in 1995, and a concentration of 790 mg/kg was detected in post-excavation sample CFB-68B at 2 feet bgs. Details of this test pit program are provided in **Appendix A**.

3.3.9 April 2017 Groundwater Monitoring (AEI, 2017c)

To provide a more current picture of groundwater quality, samples were collected from twelve existing groundwater monitoring wells (MW-12S, MW-2S, MW-302D, MW-31D, MW-31S, MP-3I, MP-3S, MW-102D, MW-102S, MW-302S, MW-34D, and MW-34S) for analysis of PCB Aroclors, Congeners and/or VOCs. Three of these wells (MW-2S, MP-3S, and MP-3I) were selected due to their location near TP-5 where high concentrations of PCBs were detected in shallow soil.

PCB Aroclors were detected in only 1 of the 12 monitoring wells sampled at a concentration greater than the EPA MCL of 0.5 µg/L. The sole exception was well MP-3S, which exhibited 9 µg/L. However, a deeper well in this same location (MP-3I) had only 0.33 µg/L. PCB Congeners were detected in each of the five wells sampled, but were detected in only 2 of the monitoring wells at a concentration greater than the EPA MCL of 0.5 µg/L. The highest PCB Congener concentrations were observed in shallow and intermediate wells MP-3S and MP-3I (6,968 ng/L and 2,421 ng/L, respectively). These wells are located at the southwest corner of the Site. The lowest concentration of PCB congeners was observed in MW-12S (130.5 ng/L), which is located on the north side of the Site.

VOC data collected in April 2017 generally show similar concentrations as those collected during the SRI (AECOM, 2016b) in June 2012 and 2014. Both the April 2017 and the SRI/PDI data (AECOM, 2016b) showed that the highest VOC concentrations are in the deeper monitoring wells (>20 feet below grade). However, the deepest well sampled (MW-34D) had no VOCs detected. Details of the groundwater monitoring program are presented in **Appendix B**.

3.3.10 July 2017 Conceptual Site Model and Risk Evaluation (AEI, 2017a)

Based upon the previous environmental investigations and remediation, a preliminary design evaluation and response to public comment on the proposed remedy, a refinement of the soil and groundwater remedial approaches were identified and presented in a conceptual site model/risk evaluation/preliminary design package submitted July 13, 2017 to EPA and RIDEM (**Appendix C**). This approach is outlined in Section 1.0. Overall, the basis for remediation remained similar to the 2016 CMS and SOB (excavation of soil and groundwater treatment using ISCO), however, BASF proposed to utilize a TSCA risk-based approach, as allowed under 40 CFR 761.61(c), to address PCB-impacted soil contamination. The EPA and the RIDEM have each provided preliminary approval pending the approval details provided in this CMI.

MW12 in 1995 ⇒ 30ppb Congener data 0.13ppb -

As discussed in Section 1.0, the specific remediation goals for PCB remedial action now include:

1. Removal and off-site disposal, at an approved facility, of all soil impacted with PCBs greater than or equal to 25 mg/kg, AND, as necessary, additional soil with PCB content greater than or equal to 10 mg/kg, such that the resulting Exposure Point Concentration, as calculated by the 95% Upper Confidence Level, is less than 10 mg/kg. These criteria constitute the MPS for PCBs in soil.
2. Within the FEMA Floodway, since capping and elevation increases are not permitte according to FEMA regulations, PCB-impacted soils ≥1 mg/kg will be removed.
3. To eliminate the potential for direct contact of remaining soil impacts and limit dissolved phase mobility concerns, the following clean soil cover remedy will be installed an maintained:
    1. For areas where PCBs greater than or equal to 10 mg/kg and < 25 mg/kg remain soils not already sequestered under existing concrete (i.e., existing in-situ slabs will be covered with an impermeable HDPE cover material (to limit dissolved-phas mobility), and a permeable geotextile will be installed over these materials in a generally continuous manner over the soils with ≥10 mg/kg PCBs to limit the potential for direct contact.
    2. Given (1.), for areas where PCB impacts are ≥1 <10 mg/kg, a RIDEM soil cove consisting of permeable geotextile covered with two feet of clean soil (c equivalent) and vegetated surface will be installed and maintained to limit direc contact.

3.4 Nature and Extent of Contamination

3.4.1 PCBs and VOCs in Soil

PCB grid sampling conducted during 2013/2014 set out to fully characterize the extent of the PCB impacts located at the Site. While it was believed that the majority of the PCB impacts had been characterized and remediated during a previous IRM in 1995, several pockets of shallow surface soil impacted by PCBs that are in excess of the current 25 mg/kg PCBs MPS have been delineated. **Figure 4** provides a graphical summary of the results of the PCB soil analyses on Lot 1102 (AECOM, 2016a, Figure 9). These data indicate that there are 57 soil sample locations where PCB non-compliant soils exist and require removal. **Figures 16** through **19** presented in **Appendix C** present cross-section type depictions of the PCB concentrations in subsurface soils for select areas of the Site. The PCB soil analytical data tables, including samples which were excavated during the 1995 IRM, are presented in **Attachment 2**.

Additionally, based on soil data collected during the SRI, PDI, and CMS, Lot 1102 showed a shallow VOC mass of toluene and 2-chlorotoluene present in soils near SWMU-11, most likely

from the historical toluene spill, discussed in **Section 3.3.5** and shown in Figure 16 of the 2016 CMS. This VOC mass was detected in the vadose zone soils (2-6 feet bgs) collected in the southwest corner of the former Building 11 footprint, where the SVE system was implemented from 1997 to 2005. Because the VOC-impacted soils are co-located with PCB-impacted soils, the remedial measure will involve removal and disposal of these soils to remove the source mass. Direct oxidant injection is also proposed to treat the remaining vadose soils and underlying groundwater impacts as presented in AECOM (2016a).

3.4.2 Deep and Shallow Groundwater

The Site has shown shallow (< 20 feet bgs) and deep (> 20 feet bgs) detections of VOCs in excess of the RIDEM GB and Site-specific VOC MPS based on data collected during the RFI, SRI and 2017 groundwater monitoring programs. Residual groundwater impacts are limited to the southwestern quadrant of Lot 1102 and are associated with past plant operations that occurred primarily in Buildings 11 and 16. Building 16 was associated with a former sump leak. Pre-design Investigation (PDI) data collected in September 2014 (AECOM 2016a) also show residual soil and groundwater impacts associated with SWMU-11. **Figure 20 in Appendix C** shows the extent of shallow and deep groundwater VOC impacts to be addressed by a combination of excavation, ISCO and MNA. The design and monitoring parameters for the in-situ portions will be determined through pilot testing.

3.5 Cleanup Standards

3.5.1 Remedial Objectives

Remedial objective elements for the Site will be to:

- Eliminate direct contact to impacted soil through excavation and off-Site disposal of soils containing greater than or equal to 25 mg/kg PCBs, and covering remaining soils containing greater than or equal to 1 mg/kg PCBs with permeable geotextile and 2-ft of clean soil. An impermeable HDPE cover material will be used in excavation areas not achieving less than 10 mg/kg PCBs or areas where soils contain greater than or equal to 10 mg/kg PCBs, but less than 25 mg/kg and are not covered by concrete slabs. The impermeable cover addresses the RIDEM GB Leachability standard. The 2-foot clean soil cover will eliminate the risk to humans of direct contact with impacted soil and thereby meet the requirements for an alternative TSCA risk-based closure under 40 CFR Part 761 (c).
- Within the FEMA Floodway, since capping and elevation increases are not permitted according to FEMA regulations, PCB-impacted soils ≥1 mg/kg will be removed.

- Remove VOC source delineated at SWMU-11/former Building 11. Source removal will involve excavating shallow soils from a depth of 0-6 feet bgs, or to depth of groundwater whichever is deeper, containing greater than 54 mg/kg toluene (RIDEM GB leachability standard, no such standard exists for 2-chlorotoluene) and 1,000 mg/kg of chlorobenzene (RIDEM GB Leachability standard).
- Eliminate COC migration: PCBs in soil through removal and/or covering, and dissolved VOCs in groundwater through ISCO mass destruction technologies.

3.5.2 Soil Objectives

The objective of the soil remedial program is to address direct exposure to PCB and VOC-impacted soils. As discussed in **Appendix C** (AEI 2017a), the chosen method to achieve compliance is removal and disposal off-Site, at an approved facility, of soils impacted with PCBs greater than or equal to 25 mg/kg, except in the FEMA Floodway where a metric of <1 mg/kg must be achieved, and surface soils in the SWMU-11 area impacted with toluene, ethylbenzene and xylenes at concentrations believed to be contributing to the groundwater MPS exceedances as discussed in **Section 3.3.5**.

As detailed in **Appendix C**, the 25 mg/kg PCB remediation goal was defined evaluating the 95% upper confidence limit (UCL) of the mean PCB concentrations existing on-Site for three scenarios: 1) the data set with no soil removal; 2) the data set with no soil removal except for the unique area in and around TP-5 in the southwest corner of the Site which will be addressed comprehensively through the completion of an excavation below the water table; and 3) the data set after future excavation of soils with >25 mg/kg PCBs. The evaluation showed that the post-remedy 95% UCL concentration will meet the goal of less than 10 mg/kg after removal of the of soils with PCBs at concentrations greater than 25 mg/kg. Therefore, the new MPS for PCBs for this Site is a 95% UCL concentration of 10 mg/kg. The TSCA post-excavation verification sampling plan presented in **Appendix F** will be used to verify that the MPS in the remaining soils has been achieved.

To further address direct exposure to PCB-impacted soils, soils present at any depth containing greater than or equal to 1 mg/kg PCBs will be covered using a clean soil cover . Details are provided in **Section 4.0.**

3.5.3 Groundwater Objectives

The objectives of the groundwater remedial program are to employ source destruction via ISCO and monitored natural attenuation (MNA) technologies to reduce upland groundwater VOC impacts to meet Site-specific MPS and RIDEM GB standards in the area of SWMU-11 and employ ISCO technology (ozone reactive barrier) to reduce or eliminate site-related VOC-impacted

groundwater from discharging into the Pawtuxet River. The groundwater remediation plans for the Site are further outlined in **Section 4.2.4**. Details of the groundwater ozone reactive barrier design will be developed under separate cover.

4.0 CORRECTIVE MEASURES IMPLEMENTATION DESIGN

Sections 4.0 and 5.0 include the Site Closure Final Design, which involves both a soil and partial groundwater remedial effort (SWMU-11 area only). The soil remedy final design discussed in both sections is inclusive of:

- Basis for Design/Scope (**Section 1** and **Section 4.1**)
- Human Health Risk Evaluation (**Appendix D**)
- Contract Drawings (**Appendix E**)
- Technical Specifications (**Appendix E**)
- Soil Disposal Calculations (**Section 4.2.1.2**)
- Supporting Documentation: Sample and Analysis Plan/Quality Assurance Project Plan (**Appendix F**), Template Environmental Land Use Restriction (**Appendix G**), Template Soil and Groundwater Monitoring Plan (**Appendix H**), Soil Erosion and Sediment Control Plan (**Appendix I**), Soil Cover Inspection and Maintenance Plan (**Appendix J**), Traffic Management Plan (**Contract Drawing, C-3 General Site Plan**), Health and Safety Plan (**Appendix K**), Sediment Monitoring Plan (**Section 6.2**)
- Permitting Requirements (**Section 5.1**)
- Project Schedule (**Section 7.1**)

4.1 Design Scope

The Site closure soil and groundwater remedial approach will be designed in accordance with both the federal Toxic Substance Control Act at 40 CFR 260-270/761, administered by US EPA Region I (EPA), the RIDEM Rules and Regulations for the Investigation and Remediation of Hazardous Material Releases (Remediation Regulations) for VOC and PCB cleanups (DEM-DSR-01-93, as amended) and the RIDEM Rules and Regulations for Governing the Administration and Enforcement of the Freshwater Wetlands Act (7/16/2014).

The Project Scoping Documents serve as the basis for the Final Design, are presented in this Section.

4.2 Soil Remedial Approach

The soil remedial actions described in the previous Sections will be implemented during one continuous construction season in 2018 (i.e., April to September, allowing for re-seeding to be established per local soil erosion agency guidelines). A summary of the components of the remedial action approach for soil is presented as follows:

1. Remove soils with PCB concentrations >25 mg/kg. Fill excavation with soils stockpiled on-site that contain <10 mg/kg PCB and install cover materials(s) defined as permeable geotextile and impermeable HDPE, as appropriate, as described in bullets 5 and 6, cover with 2 ft of clean soil as defined in bullet #7, and bring to grade as appropriate, all based on the remaining PCB soil concentrations.
2. In the FEMA Floodway, removal of soils with PCB concentrations >=1 mg/kg. Replace all excavated soil with clean soil as defined in bullet #7.
3. Remove soils containing elevated VOCs in the SWMU-11 area to the groundwater table and fill excavation with soils stockpiled on-site that contain <10 mg/kg PCB. Install cover material(s) as described in bullets 5 and 6, cover with clean soil as defined in bullet #7, and bring to grade as appropriate, all based on the remaining PCB soil concentrations.
4. Remove additional soils as necessary with PCB concentrations >=10 mg/kg such that the 95% UCL target across the site is <10 mg/kg.
5. To ensure PCB leaching potential is minimized, areas with remaining soil containing PCB >=10 mg/kg and <=25 mg/kg will be covered with an impermeable material, either in-situ concrete where the soils are sequestered below such infrastructure, or cover the surface area with an impermeable HDPE cover material. The areas which are anticipated to require the HDPE cover material are shown on Contract Drawing C-6. The 2 ft clean soil cover defined in item #7 below will also cover all permeable and impermeable cover materials and BASF will seek approval for a variance to the RIDEM Wetlands regulations through the filing of a Preliminary Determination of Applicability. This will include the results of the FEMA floodway modelling which has shown that the installation of the 2-foot clean soil cover will not result in a significant change in the local flood elevations. If a variance is not approved by RIDEM Wetlands for the agreed upon soil and membrane cover requirements, EPA will be notified, and a compromise will need to be entered into by all parties.
6. All areas with PCB >=10 mg/kg and <=25 mg/kg remaining will also be covered by a uniform permeable geotextile material (extended beyond the outermost 10 mg/kg contour) to function as an impediment to unauthorized invasive activity and as a witness layer as part of the whole site cover. The permeable geotextile will cover all areas including those that need the impermeable cover material and those that have concrete slabs in place over soils >10 ppm mg/kg and <=25 mg/kg.
7. All areas with PCB >1 mg/kg will be covered with the permeable witness layer introduced in bullet 6 and by a uniform clean 2-ft soil cover extended beyond the outermost 1 mg/kg contour and tested to meet the applicable RIDEM requirements (the Residential Direct Exposure Criteria) and PCBs <1 mg/kg and in accordance with the Project Technical Specifications (Appendix E). The permeable witness layer need not be installed in the 20-foot wide sewer easement area which is parallel to the warehouse building on the northern side of lot 1102 but this sewer easement area will be addressed in the soil management plan as part of the environmental land usage restriction.
8. The remedial plan described above is intended to meet both TSCA and RIDEM Remedial Regulations, function as an impediment to unauthorized invasive activity and limit impact

to groundwater considerations. In addition, at a minimum, the soil cover will provide a substrate to support an enhanced upland habitat vegetation landscaping scheme.

9. A PCB deed notice, required for any area where PCBs remain at >=1 mg/kg, and an environmental land usage restriction which includes a soil management plan as required by the RIDEM, will be entered into as a joint document, if possible, and will be recorded on the deed as required by the EPA TSCA program and the RIDEM.
10. In all areas on-site, the 2-ft clean soil cover will be defined as in bullet #7. For soils required to fill excavations that will be below the 2-ft soil cover in areas that are outside the FEMA Floodway, soils stockpiled on-site that contain PCBs <10 mg/kg may be used if included in the TSCA approval and specific soil data supports that the PCB concentrations are <10 mg/kg.

Specific to the 10 mg/kg metric: For all areas defined with PCBs >25 mg/kg, the goal will be to achieve <10 mg/kg at the extent of these excavations, as feasible, in order to minimize the use of impermeable cover material to address leachability issues. Excavations will not extend below the water table (except for the TP-5 area) and may be halted if subsurface obstructions are encountered. If the <10 mg/kg goal is not achieved in an area designated for excavation, that area will be covered with an impermeable HDPE cover material. Areas with PCBs <=25 mg/kg, but >=10 mg/kg will be covered with an impermeable HDPE cover material if there is no concrete slab present to prevent leaching into groundwater. The areas which are anticipated to require the HDPE cover material (Nilex 40 mil HDPE, or equivalent) and/or the geotextile (Mirafi 180N or equivalent) are shown on Contract Drawing C-6. As shown on Contract Drawing C-6, there will be no impermeable cover material installed within the Floodway and the amount of impermeable cover material within Zone AE has been minimized such that there will be no reduction in infiltration which will be documented in the Floodway modelling to be submitted with the Wetlands Preliminary Determination Application.

In summary, where PCBs < 1mg/kg remain - cover with clean soil as defined in bullet #7. Where PCBs >= 1mg/kg and <10 mg/kg remain - cover with cover material and 2 ft clean soil and see bullet #10 for further guidance. Where PCBs >=10 mg/kg and <=25 mg/kg remain - addition of an impermeable cover material, where there does not already exist an in-situ concrete slab, and permeable geotextile and 2-ft of clean soil and see bullet #10 for further guidance. Remove soils with PCBs >25 mg/kg - fill excavations as explained in bullet #10, install cover material (s) as described in bullets 5 and 6, cover with clean soil as explained in bullet #7 and bring to grade as appropriate, all based on the remaining PCB soil concentrations.

Full scale contract drawings, technical specifications and plans for the soil remedial measures are provided in the Remedial Design which is presented in **Appendix E**, and key design elements are reviewed below.

4.2.1 Soil Remedial Measure

4.2.1.1 Site Preparation and Pre-Excavation Planning

The awarded contractor shall prepare the Site in accordance with the specified plans and technical specifications, including permitting requirements (further discussed in **Section 5.0**). Site preparation activities will include:

- Clearing of brush vegetation, removal of trees and stumps, and mowing over the entire site, except in the Floodway, and grubbing (removal of brush and tree stumps) only for soil excavation areas;
- Construction of Site Entrance and Exit Roads, Temporary Gravel Access Road and Decontamination Pad;
- Establishment of Stockpile / Debris / Concrete Management Areas; and
- Installation of Erosion and Sedimentation Controls.

4.2.1.2 ISCO Ozone Pilot Test Pad

In preparation for an ozone ISCO pilot study and final remedy adjacent to the Pawtuxet River, a structural soil pad will be constructed in conjunction with Site preparation activities and conforming to the details below. The pad will be designed to support the dead-loads associated with the ozone ISCO pilot program. The infrastructure will include compressors, generators, a small equipment/personnel storage shed, support vehicles, drilling equipment and tanks/drums.

The work area, or pad, as defined on the attached **Contract Drawing D-1, Details 1** in **Appendix E**, will be prepared by first clearing the area, then removing soils with PCBs >25 mg/kg outside the FEMA Floodway and PCBs > 1 mg/kg in the FEMA Floodway. Overlying clean soils, historical backfill provided during the 1995 IRM, will be disposed of with the excavated PCB soils. The remaining clean soil layer which had been installed during the prior remediation program (1995 IRM) as discussed in **Section 3.3.3**, will be assumed contaminated and will be covered by the clean soil cover. Approximately 190 cy of soil greater than or equal to 10 mg/kg PCB will be disposed off-Site and approximately 30 cy of soil with less than 10 mg/kg PCB will be managed through stockpiling for on-Site reuse.

The pad will consist of an 8-inch gravel borrow subbase course, 2-inch graded screened aggregate course and 2-inch chip stone, underlain by either permeable geotextile (Mirafi 180N, or equivalent) or permeable geotextile and HDPE cover material (Nilex 40 mil HDPE, or equivalent), depending upon final PCB concentrations (i.e., >= or <10 mg/kg PCBs). The soil pad materials will meet RIDOT specifications, clean fill RIDEM Remediation Regulations residential direct exposure criteria and GA leachability criteria specification requirements and TSCA 40 CFR 761.61 PCB unrestricted use requirements. The pad will be constructed to sustain loading of equipment,

materials and a storage shed. A plan and detail for the pad are shown on **Contract Drawing D-1, Details 1** in **Appendix E.**

4.2.1.3 Removal of PCB-Impacted Soils

The removal and disposal of PCB-impacted soils exceeding 25 mg/kg on the Site involves excavation and handling of the approximate quantities:

- Soil Type 1C (PCBs >10mg/kg <25mg/kg): 562 cubic yards
- Soil Type 2A (PCBs >25mg/kg <50mg/kg): 636 cubic yards
- Soil Type 2B (PCBs >50mg/kg <100mg/kg): 880 cubic yards
- Soil Type 2C (PCBs >100mg/kg): 246 cubic yards

The regrading for the portion of works being completed in the FEMA Floodway must comply with no net fill requirements. This requires the removal of approximately an additional 400 cy of Type 1B soils (PCBs >1 <10 mg/kg) from the FEMA Floodway to address the remedial objective to eliminate direct contact. Excavations outside the Floodway will receive a 2-foot clean soil cover as described in a later Section. To reduce off-Site disposal quantities and overall project costs, the excavated Floodway soils with PCB concentrations greater than or equal to 10 mg/kg will be transported off-site, while soils with less than 10 mg/kg will be used as backfill for the excavations outside the Floodway prior to installation of the clean soil cover.

Each cell designated for excavation on **Figure C-4** in **Appendix E** clearly defines the soil types for each cell. These designations are based on the highest concentrations detected in each cell, regardless of sample depth. There will be no attempt to segregate individual vertical layers of soil in any of the cell excavations based on PCB concentrations, all soils in each designated cell will be disposed as the same soil type based on the in-situ soil analyses already completed in each cell and accepted as adequate for delineation. Final excavation extents will be delineated as detailed in **Section 4.2.1.8.**

Soil Types 1B and 1C apply only to the FEMA Floodway and a small area adjacent to the FEMA Floodway at the southeast corner of the Site. The sequence of excavation is currently envisioned as follows: areas in and adjacent to the FEMA Floodway where >50 mg/kg PCB soils are located will be excavated first and delineated to <25 mg/kg prior to the excavation of Type 1B, 1C and 2A soils. The 1B category was created to allow possible reuse as backfill for excavations outside the FEMA Floodway which will be covered with the clean soil cover. Type 1C soils, which will be disposed off-site, would be excavated prior to 1B soils. In areas outside the FEMA Floodway this same sequencing will be used to maximize re-use of soils. EPA will be afforded the opportunity to review the selected contractor's Excavation Plan and supporting analytical data prior to implementation.

Clean imported soils, to replicate the depth of excavation, with the top 6-inches being wetland topsoil, will be imported to re-grade the FEMA Floodway to its original surface conditions (or lower), in the northeastern one-third of the Floodway; a middle section of the Floodway is not impacted, and will not be disturbed, but it will be sampled to confirm that it is not impacted, as detailed in **Appendix F**, Sampling and Analysis Plan. A final section of the Floodway, the southwestern portion, will be excavated as needed, but will not be replanted until after ISCO Ozone pilot testing and full-scale system operation has been completed. The remaining excavations, outside the FEMA Floodway will also receive clean imported soils and be regraded so that the final clean soil cover will meet the Final Grading as specified on **Contract Drawing C-7**.

Excavated soils which contain PCBs >=10 mg/kg and <50 mg/kg will be transported for disposal at the Rhode Island Resource Recovery landfill in Johnston, RI. Soils which contain PCBs >50 mg/kg will be removed and transported off-Site for disposal at the Chemical Waste Management facility in Emelle, Alabama or U.S. Ecology Wayne Disposal in Belleville, Michigan, which are approved by EPA for TSCA waste disposal. Soils generated during the test pitting activities (**Appendix B**) discussed in **Section 3.3.8** (approximately 100 cy) which contains >50 mg/kg PCBs will also be removed from the Site and sent to one of these licensed TSCA disposal facilities.

4.2.1.4 Removal of VOC-Impacted Soils

As discussed in **Section 3.3.5**, in the vicinity of SWMU-11, which is located on the southern end of former Building 11, in the northwestern part of the Site **(Figure 2),** a documented toluene spill occurred from a pipeline to a subsurface sump at Building 11 in the early 1980s. The removal and disposal of VOC-impacted soils at SWMU-11 involves excavation and handling of the following approximate quantity:

- Soil Type 3 (PCBs >25 mg/kg with RCRA hazardous waste): 310.5 cubic yards

Soil excavation will be conducted in an approximate 20-foot by 30-foot area as shown on **Contract Drawing C-4, Remedial Excavation Plan** and on **Contract Drawing D-3, Detail 3** in **Appendix E**. Soils from the ground surface to the top of the water table (approximately six feet bgs) will be managed for off-Site transport and disposal. Toluene is a listed-waste under EPAs hazardous waste regulations (40 CFR 261) and therefore, the soil excavated must be disposed of at a Subtitle RCRA C facility as hazardous waste such as the Chemical Waste Management facility in Emelle, Alabama or U.S. Ecology Wayne Disposal in Belleville, Michigan.

Once the VOC-impacted soils are removed, a chemical oxidant, sodium persulfate, will be added into the open excavation and mixed into the remaining saturated zone soils in the bottom of the excavation. Soils will be blended by mechanical means. The persulfate addition and blending is proposed to treat in-situ the residual VOC soil contamination remaining at the bottom of the

excavation. Post-excavation samples will be collected and analyzed for PCBs (8082A/3540C) and VOCs (8260C) to verify the remedial objectives, as defined in **Section 3.6.1**, are met. The sampling program is detailed in **Appendix F**.

Additionally, a 30-foot by 40-foot area located on the eastern side of the Site, designated as SWMU-8, contained elevated concentrations of xylenes (>400 mg/kg) comingled with PCB-impacted soils. In-situ sampling detected this high xylene concentration to a depth of 2-feet bgs. PCB in-situ concentrations did not exceed 50 mg/kg at this depth. Therefore, this excavation shall proceed to a depth of 2-feet, whereby the soils excavated will be removed and disposed of as RCRA hazardous waste comingled with PCBs. The removal and disposal of VOC-impacted soils at SWMU-8 involves excavation and handling of the following approximate quantity:

- Soil Type 3 (PCBs >25 mg/kg with RCRA hazardous waste): 89 cubic yards.

Similar to SWMU-11, the Type 3 soils will be disposed of at a RCRA Subtitle C facility such as Chemical Waste Management facility in Emelle, Alabama or U.S. Ecology Wayne Disposal in Belleville, Michigan. Post excavation sampling will be conducted in accordance with the TSCA approved Sampling and Analysis Plan, as detailed in **Appendix F**. Once compliance with the remedial metric for VOCs is achieved (54 mg/kg toluene and 100 mg/kg chlorobenzene), additional excavation of PCB only impacted soils will continue to remove > 25 mg/kg soils (Soil Type 2B as designated on **Contract Drawing C-4 in Appendix E**). Final excavation extents for both SWMU-11 and 8 will be delineated as detailed in **Section 4.2.1.8**

4.2.1.5 Concrete and Debris

Concrete shall only be demolished and removed if it is encountered during excavations, and it is limiting access to the removal of PCB or VOC-impacted soils. All other concrete is to be left in-place. Concrete and/or asphalt covering PCB-contaminated soils > 25 mg/kg, which must be excavated, will be assumed to have the same PCB concentrations as the underlying highest PCB concentrations in soils and will be removed and disposed along with the soils. Debris (e.g., rebar, pipes, construction materials) encountered in excavations shall be segregated or sized by the Contractor as needed to meet the soil disposal standards of the designated facility. Uncontaminated/decontaminated metal will be recycled at a licensed recycling facility. If the metal was located within a contaminated area, the metal must be decontaminated, and PCB wipe tested prior to recycling in accordance with 40 CFR 761.300.

As an option, if above grade concrete pads that have not been in contact with >=10 mg/kg PCB-impacted soils meets the standards set forth in RIDEM's Remediation Regulations: **Technical Specification Sections 02 30 10 Remove and Dispose Reinforced Concrete Slabs,** it shall be reduced on-Site to minus 3-inch in size by the Contractor before reuse on-Site. Crushed

concrete must be used at least 1-foot below the existing grade before placement of the clean soil cover for cover protection purposes.

4.2.1.6 De-Watering

De-watering is expected in deeper excavations, especially in excavations on the southern portion of Lot 1102, including the area of TP-5, where groundwater may be encountered. The requirements for a dewatering are identified in the **Technical Specification Section 31 80 00 Dewatering and Off-Site Disposal – Areas with Contaminated Groundwater**, and includes dewatering equipment (i.e., pumps, hoses, fractionation tanks) and methods. The proposed staging area for the dewatering equipment is shown on **Contract Drawing C-3, General Site Plan** with details shown on **Contract Drawing, D-2 Detail 2.** Water managed during excavation work will be stored in fractionation tank(s) on-Site and managed by the contractor. The proposed management method is off-Site disposal at a TSCA-licensed facility such as Veolia Environmental Services in Port Arthur Texas. Testing of the water for VOCs and PCBs as needed will occur to meet disposal facility permitting requirements.

4.2.1.7 Soil Management

To avoid the need for stockpiling, live-loading of soils targeted for off-site disposal will be implemented when possible. When stockpiling is necessary, contaminated soil excavated from the Site, designated for disposal, will be placed on 20-mil high density polyethylene sheeting (HDPE) and covered with two layers of six-mil poly sheeting. The cover will be secured with sandbags or other means sufficient to prevent direct exposure by workers to the stockpiled contaminated soils and to prevent airborne migration of the stockpiled contaminated soils (migration control). Staked haybales, as detailed on **Contract Drawing, D-2 Details 2**, will be used to address potential erosion. Stockpile run-on from surface water sheet flow will be controlled via sand bag barriers and/or ditches/dikes constructed around the stockpiles in accordance with 40 CFR 761.65. A lined, low point will be created around the soil pile and inside the run-on barrier. Accumulated liquids will be removed as necessary using a vacuum truck. The run-on water will be disposed of in accordance with all federal, state and local regulations.

RCRA hazardous and non-hazardous PCB-containing soils designated for disposal, will be located in stockpiles as designated on Contract **Drawing C-3, General Site Plan** and details provided on **Contract Drawing, D-2 Details 2.** Transportation of these soils to a licensed off-Site disposal facility, as detailed above in **Section 4.2.1.3 and 4.2.1.4**, will comply with all federal, state and local transportation standards for contaminated materials. Waste disposal acceptance and manifesting will be completed prior to off-Site transport. Loading shall be conducted in a manner to minimize dust generation. The Contractor shall adhere to the requirements stipulated in **Technical Specification Sections 32 50 60 Dust Control** and **01 72 10 Construction Waste Management and Disposal**, which presents the requirements for Dust and Noise Control.

4.2.1.8 Post Excavation Verification Sampling

Post excavation samples will be collected to verify compliance with the soil cleanup standards. The post excavation sampling methods, field screening, analytical requirements, analyses and quality assurance/quality control are included in the Sample and Analysis Plan (SAP) and Quality Assurance Project Plan [QAPP] (**Appendix F**). During excavation outside the Floodway, all 847 planned soil samples will be field-screened with 20% (169) of the samples submitted for lab verification. To support the use of a hybrid field and laboratory program, a correlation study using field and off-site laboratory analyses on 25 duplicate Site samples was completed and it is included as **Attachment 3**. For the Floodway Zone, because the cleanup level is 1 mg/kg, all verification soil samples will be submitted for analysis via EPA Method 8082/3540C.

The points of compliance for soils will be defined at the extent of each excavation area. Post-excavation samples will be collected from both sidewalls and bottom along the perimeters of the excavation cells. Post excavation sampling for PCB soils will follow TSCA Subpart O as follows:

- Minimum number of samples: At each separate PCB excavation area, take a minimum of three samples for each type of bulk PCB remediation waste, regardless of the amount of each type of waste that is present.
- Selection of sample locations:
  - Use a square-based grid system to overlay the entire area to be sampled. Orient the grid axes on a magnetic north-south line centered in the area and an east-west axis perpendicular to the magnetic north-south axis also centered in the area.
  - Mark out a series of sampling points 1.5 meters apart oriented to the grid axes. The sampling points shall proceed in every direction to the extent sufficient to result in a two-dimensional grid completely overlaying the sampling area.
  - A sample will be collected at each point where the grid falls in the cleanup area. Samples will be analyzed individually, for Soxhlet extraction and analysis via EPA Method 8082/3540C or 9078 (Dexsil PCB/Chloride Analyzer).
  - Post-excavation samples will be collected from both sidewalls and bottom along the perimeters of the excavation cells. See Section 4.1 and Table 4-1 of **Appendix F** (Sampling and Analysis Plan).
- Compliance is met when the post excavation samples indicated PCB concentrations below the applicable cleanup standard. The goal is to remove PCBs to achieve <10 mg/kg in the areas identified for excavation with PCB levels >25 mg/kg, where possible, however, in areas where this cannot be achieved either due to subsurface obstructions or groundwater conditions the goal is to achieve < 25 mg/kg which will result in a 95% UCL mean PCB concentration of <10 mg/kg for this project. Areas where >=10 mg/kg PCBs remain without cover from existing concrete structures will be covered with an impermeable cover material to address leachability.

- The area of the FEMA Floodway that is not designated for excavation will be sampled to confirm compliance, as detailed in the Sampling and Analysis Plan (**Appendix F**) which shows the proposed locations of seven borings on Figure F-1 (B-896 thru 892) which will be sampled from 0-2 ft bgs for PCBs, SVOCs, pesticides, metals and cyanide, as shown on Tables 4-1 and 5-1.

Because at location SWMU 11 and SWMU-8, VOC-impacted soils are comingled with PCBs, VOCs will also be sampled from the sidewalls of the excavation (one per sidewall) and analyzed per EPA Method 8260C. VOC compliance will be achieved when the soils from the unsaturated zone exhibit concentrations below the RIDEM GB Leachability standard of 54 mg/kg (ppm) toluene and 100 mg/kg chlorobenzene; the toluene and chlorobenzene parameters are being used as an action threshold, because the other VOCs of concern, which have been encountered in the soils or groundwater historically, do not have GB criteria. These other VOCs include 1,2-dichlorobenzene, 2-chlorotoluene, and xylenes. The compliance program for groundwater remediation will be defined in a separate CMI planned to occur after the pilot ISCO programs are completed.

4.2.1.9 Backfill

Backfill operations are proposed to commence following verification of regulatory-compliant post-excavation analytical results. On-Site backfill sources proposed are the excavation of the FEMA Floodway to remove soils > 1 mg/kg PCBs, where the soil is <10 mg/kg; the stockpiled material from the 2016 RAWP conducted on adjacent Lots 1108 and 2630, which contains low-level PA and PCBs (<10 mg/kg); and other excess grading material from Lot 1102 with PCB levels < mg/kg. Backfill material will not contain >= 10 mg/kg PCBs. The PCB data for the stockpiled s from Lots 1108 and 2630 is presented in **Attachment 4**.

Off-Site fill material will be needed in the FEMA Floodway to restore grades to original conditio and to install the final clean soil covering outside the FEMA Floodway and landscaping activiti Fill material may include common borrow, topsoil and wetland topsoil (for the FEMA Floodw only). Material compliance shall follow RIDEM remediation standards as described in Desi Technical Specification **31 70 00 Analytical Testing Requirements for Imported Soil**.

Backfilled areas will be raised no higher than an elevation 2-feet below the final grades as designated on **Contract Drawing C-7, Final Grading Plan**.

4.2.2 Clean Soil Cover

After the soil excavation is complete, in areas where known PCB concentrations are equal to or above 1 mg/kg, a RIDEM-approved clean soil cover will be installed, i.e., 2-foot clean soil or equivalent over a layer of permeable geotextile (e.g., crushed stone may be used in areas where

2-feet of soil cannot be placed due to flood storage considerations, as in FEMA Zone AE per federal and RIDEM regulations) to support landscaping alternatives, and as an additional engineered impediment to potential future unapproved invasive activity. The Clean Soil Cover will extend throughout the entire Site, except the Floodway. A clean soil cover will not be required within the FEMA Floodway because soils with PCB concentrations ≥ 1 mg/kg will be removed.

Areas with PCBs >=10 mg/kg remaining will be covered with an impermeable HDPE cover material (i.e., Nilex 40 mil HDPE, or equivalent) if there is no concrete slab present to prevent leaching into groundwater. The areas proposed for the impermeable cover material are shown on **Contract Drawing C-6**. In the comprehensive area where PCBs are greater than or equal to 1 mg/kg (i.e., the outer 1 mg/kg contour) a uniform permeable geotextile will be placed over the surface, including over the impermeable cover material, and used as underlayment to the clean 2-foot soil cover. These three combined elements, impermeable cover material, geotextile and 2-ft of clean soil are referred to as a clean soil cover. Again, in areas where 2-feet of clean soil cannot be placed due to flood storage considerations, as in the FEMA Zone AE per federal regulations, 6-inches of soil over 6-inches of crushed stone may be used as an alternative. The geotextile will function as an impediment/indicator to unapproved invasive activity, and thus it needs to be of an adequate thickness (e.g., Mirafi 180N). Plans and details of the clean soil cover are included in **Contract Drawings C-6, Clean Soil Cover Plan** and **C-7, Final Grading Plan**.

Floodway Considerations: The revised October 2015 FEMA map requires Zone AE to maintain a baseline elevation below 17 feet (as referenced to the North American Vertical Datum of 1988). Therefore, the Design assumes that both FEMA and RIDEM approval is needed to increase elevations above 17 feet. A HEC-55 or equivalent hydraulic modelling evaluation is in preparation in parallel to this CMI WP, which is anticipated to successfully demonstrate that raising the existing grade by two (2) feet, or slightly higher to meet side-sloping requirements to promote drainage, will not impact FEMA flood storage requirements. FEMA allows raising the grade one foot in elevation without further permitting or approval from that agency. This evaluation will be submitted to FEMA in a process defined in their Conditional Letter of Map Revision Process, MT-2 Application (https://www.fema.gov/conditional-letter-map-revision); FEMA has been contacted and is providing their hydrographic data, which BASF will supplement with additional field data which is needed to make the technical demonstration.

RIDEM has other requirements concerning raising the existing elevation by any amount. A separate technical demonstration is required to allow the requested two-foot elevation; BASF is in discussions now with the RIDEM wetlands staff to determine their requirements for such a demonstration.

Two concept designs are included for the final landscaping, which are designed to support an upland wetland habitat or a dog park (**Contract Drawings L1, L2, L1-A, L2-A, L3 and L4**).

Final landscaping Site wide will be implemented in conjunction with the clean soil cover installation, including in the Floodway. Except, as indicated on the landscaping plans, within the southern portion of the Floodway, no final landscaping measures will be implemented due to the set-up and on-going ISCO ozone pilot program. The final landscaping will be completed following the complete installation of this technology. The Contractor will adhere to the technical specifications about clean soil cover materials, geotextile, final grades and landscaping requirements.

4.2.3 ELUR

An ELUR will be placed on Lot 1102 once remedial activities are complete. The ELUR will specify, at a minimum, the following:

1. No residential use allowed except as may be approved by the Department as a Recreational Facility for Public Use under the RIDEM remedial regulations.
2. No groundwater uses except as required for remedy monitoring.
3. Operation and maintenance of the surface cover areas and vegetative support as per an EPA-approved O&M plan.
4. Annual reporting to the RIDEM for ELUR compliance.
5. No invasive work below the covered areas is allowed without implementing a RIDEM-approved soil management plan and clean soil cover integrity plan (e.g., as may be required for utility maintenance).

A template ELUR is included with this submittal in **Appendix G**. Upon completion of the remedial action and approval by EPA/RIDEM, the ELUR will be prepared, completed and filed with the City of Cranston land evidence records.

The template ELUR also includes a General Soil and Groundwater Management Plan ("SGMP") as Exhibit D in **Appendix H** to address soil in the areas at the Property not inclusive of those requiring a SGMP. Following remedial measures, the SGMP will be prepared and submitted for RIDEM approval and filed with the ELUR.

4.2.4 Groundwater Remedial Approach

Groundwater remedial measures will be required to address the non-compliance with the Remediation Regulations GB soil objectives for VOCs and site-specific VOC MPS non-compliance. The remedial measures include soil mixing ISCO for the SWMU-11 area, installation and operation of an ozone ISCO reactive barrier to address migration of VOCs to the adjacent Pawtuxet River, and long-term verification monitoring. A description of the groundwater VOC remedial measures follows, but as previously mentioned, details regarding the ozone ISCO reactive barrier system

design will be submitted under a separate CMI work plan. At this time, because the remedial action proposed for the SMWU-11 area is linked to the soil remedy through excavation (**Section 4.2.1.4**), this component is detailed in this CMI WP for approval

4.2.4.1 Residual Upland Groundwater Contamination

For impacted groundwater in the vicinity of SWMU-11, ISCO applied via mixing is proposed to achieve compliance. As discussed in **Section 4.2.1.4**, once the VOC-impacted soils above the water table are removed, a chemical oxidant (proposed sodium persulfate) will be added into the open excavation and mixed into the remaining saturated zone soils in the bottom of the excavation. Soils will be blended by mechanical means. The persulfate addition and blending is proposed to treat in-situ the residual VOC soil contamination remaining at the bottom of the excavation. The envisioned sequencing will proceed by removing approximately one-quarter of the target SWMU-11 area at a time. Once one soil quadrant is excavated, and the top of groundwater is reached, ISCO reagent will be lowered down via backhoe bucket into the exposed groundwater. The bucket will mechanically mix the reagent (1,250 gallons of a 5% to 7% Catalyzed Sodium Persulfate solution or equivalent per quadrant) in the exposed groundwater. Mixing will occur as deep as practical with the available equipment, but not less than 2 feet into the saturated zone. After mixing has been completed, sidewall sampling as discussed in **Section 4.2.1.8**, will be conducted to show compliance with the VOC and PCB remedial objectives in this area. Once achieving the VOC and PCB metrics, backfill containing < 10 mg/kg PCBs will be placed into the excavation until grade is re-established. This process will be repeated until each of the four quadrants of SWMU-11 is remediated.

4.2.4.2 COC Migration Control

In accordance with the 2016 AECOM CMS and draft SOB (EPA 2016), an ozone ISCO reactive barrier system will be installed parallel to the river bulkhead and normal to the groundwater flow direction to destroy VOC mass in-situ before it migrates off-Site and discharges to the Pawtuxet River. The full in-situ reactive barrier is being separately scoped and designed by others. The proposed oxidant is ozone, and it will be applied to the aquifer in a continuous fashion using a line of wells that overlap in their volume of influence (a sparge application). The remedy will commence as a pilot operation and may need to be run for several years until such time as upgradient and downgradient monitoring show that the media protection standards have been met. The remedy design including the treatment volume, number and orientation of injection wells, and monitoring requirements will be determined from a pilot testing program.

The PCB sampling should be conducted after addition of chem. oxidant.

5.0 Corrective Measures Implementation and Construction Plans

This Section outlines the construction-related plans that will be needed to implement this work.

5.1 Permitting

Portions of the Site are located in the restricted portion of the flood plain (denoted as Flood Zone AE and FEMA Floodway), as shown on **Figure 2**. FEMA limits raising the existing grade to one (1) foot above current grade in Zone AE, yet two (2) feet or somewhat more (due to side-sloping considerations) will be needed to allow installation of the required two-foot clean soil cover. For Zone AE, it is proposed to demonstrate to FEMA, copy to RIDEM, using a FEMA-approved hydraulic modelling analysis, that the remedial work will not significantly decrease flood storage in a FEMA Map Revision process revised in April 2017. The outcome is a Letter of Map Revision issued by FEMA. The process is as follows:

- A request for a Conditional Letter of Map Revision (CLOMR) is issued electronically through the completion of the applicable MT-2 Application Forms (including Overview and Concurrence Form, Riverine Hydrology & Hydraulics Form) and provision of supporting documentation as required under the National Flood Insurance Program (NFIP) – including the pre- and post-project hydraulic models (HEC-RAS) of the subject reach of the Pawtuxet River conforming to NFIP standards;
- Utilize drainage area, peak flow, and other information pertaining to the detailed study of the Pawtuxet River contained in the Flood Insurance Studies (FIS) for Providence and Kent Counties. Prepare and submit a request for the FIS technical data (hydrologic and hydraulic backup data) to the FEMA Engineering Library to enable creation of the duplicate effective (FIS) model;

The following information will be needed for the application, the first two items of which have already been obtained during the Preliminary Design:

- Digital topographic mapping of the subject property upon which fill will be placed for covering of non-compliant soils. Mapping shall be prepared by a RI-registered Professional Land Surveyor, referenced to the RI State Plane Coordinate System and NAVD88 vertical datum, depict elevation contours at 1-foot intervals, and be furnished in an Autodesk/AutoCAD-compatible format;
- Digital files showing post-project elevation contours associated with the proposed filling and grading of the clean soil cover;
- Topographic/bathymetric cross-sections of the Pawtuxet River channel at the following locations:):

- Cross Section "N" as shown on the effective FIRM panel containing the subject property (No. 44007C0318H, Rev. 10/2/2015)
- Sections approximately 10 feet upstream and downstream of the railroad bridge (see below)
- One additional cross-section between FEMA Cross Section "N" and the railroad bridge
- All sections shall be taken perpendicular to the direction of river flow and show elevations referenced to the NAVD88 vertical datum.

- Dimensions and elevations of the existing railroad bridge near the downstream limits of the property (surveyed or from as-built drawings), including pier locations/dimensions, the low chord of spans, etc.;
- Documentation/correspondence pertaining to Endangered Species Act (ESA) consultation with the US Fish and Wildlife Service, and RIDEM, which is obtained in a standard letter request, and is anticipated to result in a negative determination.

RIDEM has other requirements concerning raising the existing elevation by any amount. A separate technical demonstration is required to allow the requested two-foot elevation change; BASF is in discussions now with the RIDEM wetlands staff to determine their requirements for such a demonstration.

The other permits/approvals anticipated will include the following: Underground utility clearance, RIDEM Soil Erosion and Sediment Control (SESC) Plan, RI Discharge Permit (RIPDES), and an Underground Injection Permit (UIC), as needed.

5.2 Community Relations Plan

Community relations are an important aspect of project planning, both pre-construction (what to expect) and during construction (are expectations being met). The Plan provides stakeholders with a formal process to voice questions and concerns for improved cooperation and understanding of the RCRA corrective actions taking place at the Site.

The Site is surrounded by both industrial and residential properties. Residences are located less than 100 feet from the Site boundary. Safety Kleen operates a waste storage facility to the south and west of the Site. A concern for many of the residences is the added truck traffic beyond those associated with the Safety Kleen facility. During the Site investigation and remedy selection process BASF has engaged the community regularly and has remained open about current and future investigation and remedial efforts. BASF wishes to continue that open communication during the implementation of the CMI.

Specifically, BASF will do the following to ensure the community is informed about the work covered by this work plan:

- Prepare and distribute a public notice and an updated fact sheet at the completion of engineering design.
- Before implementing the general soil remedy currently envisioned to occur during the 2018 construction season, conduct a public information session to address questions.
- Revise the Community Relations Plan to include any material changes in the level of concern or information needs of the community during design and construction activities.

Questions, concerns and other project related matters will be referred to David Johnson, BASF Corporate Community Relations Manager:

Phone: 973-245-5389

Communications Hotline After Hours: 862-227-6855

5.3 Pre-Construction Activities

Contractor personnel, equipment and materials will be mobilized on-Site in accordance with the project schedule and sequence of construction activities. Personnel responsible for health and safety, construction supervision and construction quality assurance will be identified prior to mobilization. Where required under the Final Design Plans and/or Contractor submittals, Site-specific training (i.e., HAZWOPER) and/or certification shall be verified and documented prior to the worker's arrival at the Site.

Site preparation activities will include the following:

- Implement site security measures. The construction area will be secured in advance of and at the end of each workday. The contractor will be required to use temporary fencing and/or barriers to accomplish this, if necessary. It will be the contractor's responsibility to install the fencing/barriers during the construction activities. BASF and/or AEI personnel will inspect the fencing/barriers to confirm it adequately secures the site. No trespassing signs will be affixed to the temporary fencing and/or barriers. The Contractor's on-Site personnel who are responsible for site security will be identified in the Contractor Health & Safety Plan.
- Delineate exclusion, contaminant reduction and support zones, which are the three zones typically established for this type of cleanup.
- Establish decontamination stations for personnel and equipment in the contaminant reduction zone. All equipment, personnel and materials that enter the exclusion zone, must be decontaminated in the contaminant reduction zone prior to entrance into the support zone.

- Prepare temporary waste accumulation areas including, but not limited to soil stockpiles, concrete, debris, waste storage for containers (i.e., drums and/or roll-offs) in accordance with the Contract Documents, details and as specified under Section 4.2.1.7. No storage of materials, stockpiling or equipment refueling is permitted in the 200-foot wetland buffer zone as shown on **Contract Drawing, C-3 General Site Plan**.
- Local horizontal and vertical survey controls will be established at the Site by a registered land surveyor as shown on **Contract Drawing, C-5 Excavation Location Plan**. Survey control points and grade stakes will be established and protected through the construction period. At the completion of construction, permanent construction features including monitoring wells, ozone and ISCO injection points, final clean soil cover grades and other new Site features will be documented.

5.4 Contractor Standards – Soil Remedy

5.4.1 Contract Drawings and Design Specifications

The Contractor shall receive Contract Drawings and Technical Specifications as part of the upcoming Contractor bid/procurement process. The following Contract Drawings and Technical Specifications will be submitted to and utilized by the Contractor during the construction phase.

List of Contract Drawings

Sheet	Title
T-1	Cover Sheet
C-1	Legend and Notes
C-2	Site and Survey Plan
C-3	General Site Plan
C-4	Remedial Excavation Plan
C-5	Excavation Location Plan
C-6	Clean Soil Cover Plan
C-7	Final Grading Plan
D-1	Details 1
D-2	Details 2
D-3	Details 3
L-1	Planting Plan – Phase I
L-2	Planting Details, Notes and Schedule
L-1A	Planting Plan Alternative – Phase I
L-2A	Planting Details, Notes and Schedule (Alternative)
L-3	Site Details
L-4	Site Details

List of Technical Specifications

D1 - General Requirements

01 31 19	Pre-Construction Conference
01 31 60	Project Progress Meetings
01 32 00	Project Schedule and Progress Reports
01 60 00	Health and Safety Requirements
01 90 05	Field Office
01 92 00	Temporary Utilities
01 72 10	Construction Waste Management and Disposal

D2 - Existing Conditions

02 20 00	Site Preparation
02 30 10	Remove and Dispose Reinforced Concrete Slabs
02 30 80	Remove and Dispose Miscellaneous Materials
02 37 10	Clearing Grubbing
02 50 55	Asbestos Containing Material Pipe and Conduit Abatement
02 80 25	Abandon Septic Tank

D31 - Earthwork

31 05 00	Regulatory Requirements
31 10 00	Earthwork
31 20 00	Temporary Earth Retaining Systems
31 60 05	Contaminated Soil Excavation
31 60 40	Handling, Hauling, and Stockpile Management of Contaminated Soils
31 62 75	Soil Stockpile – Contaminated Soil
31 66 00	Non-Woven Geotextile Fabric – Clean Soil Covered Areas
31 70 00	Analytical Testing Requirements for Imported Soil
31 80 00	Dewatering and Offsite Disposal – Areas with Contaminated Groundwater

D32 - Erosion Control

32 00 00	Erosion and Sediment Control
32 20 00	Compost Filter Sock
32 22 00	Silt Fence Type II
32 30 20	Equipment and Personnel Decontamination Facilities
32 31 19	Site Furnishings
32 50 60	Dust Control
32 80 15	Failure to Maintain Erosion and Pollution Controls
32 92 19	Seeding
32 93 01	Planting

D33 - Exterior Improvements

33 60 10	Turf Reinforcement Mat

5.4.2 Set-up Plans

Project plans included in the Final Design for Contractor reference are as follows:

- Traffic Management (**Contract Drawing, C-3 General Site Plan**)
- Noise and Dust Control (**Technical Specification 32 50 60 Dust Control and Section 01 72 10 Construction Waste Management, respectively**)
- Soil Erosion and Sediment Control Plan (**Appendix I**)
- Equipment and Personnel Decontamination (**Submittal by Contractor as included in Technical Specification Section 32 30 20 Equipment and Personnel Decontamination**)
- Communication/Public Relations (**Section 5.2 of this CMI WP**)
- Health & Safety (**Appendix K**)

Plans will be prepared in accordance with all state/federal/local standards. Further details on each of the above components is presented below.

5.4.3 Contingency Plan

BASF specifications for this project include the following contingency plan procedures. The Contractor will alert on-Site BASF and/or AEI personnel if an unexpected incident involving hazardous materials occurs. These types of incidents could include but are not be limited to encountering non-compliant soils and/or groundwater in areas other than those defined in the project specifications and plans, a hazardous material release from on-site equipment, and an accidental petroleum release from the on-site construction equipment station. If no BASF and/or AEI personnel are on-site then the contractor will contact BASF and/or AEI. BASF and/or AEI shall be responsible for contacting appropriate regulatory agency personnel that must also be notified. Prior to this project commencing BASF will identify its personnel that will be responsible for regulatory agency notification. The regulatory contact information is provided below.

- Rhode Island Department of Environmental Management 24-hour response number 401-222-3070
- U. S. EPA
- National Response Center (NRC) at 1-800-424-8802 or 1-202-426-2675
- Cranston Fire Department 911
- Cranston Police Department 911

The following information shall be communicated when reporting to agencies:

- Name, title, telephone number and address of reporter;
- Name, telephone number and address of the site/spill;

- Time, type and amount of material involved;
- Extent of injuries/illnesses, if known;
- Possible hazards to human health and the environment;
- Any body of water involved;
- The cause of the accident/spill; and
- The action taken or proposed by the site personnel.

5.4.4 Health and Safety

AEI has prepared a representative Health and Safety Plan (HASP) in **Appendix K** as part of the Final Design. The Contractor will be required to submit its own Health and Safety Plan consistent with the AEI and BASF health and safety plans and policies, technical specifications and all applicable federal, state and local standards prior to mobilization and construction activities. The HASP includes requirements for Site perimeter air monitoring to protect potential off-site residential receptors.

5.5 Construction

5.5.1 Storm Water and Erosion Controls

Prior to intrusive activities, the Contractor shall implement the best management practices (BMPs) specified in the Soil Erosion and Sediment Control Plan (SESC). The locations of BMPs are shown on **Contract Drawing C-3, General Site Plan** and described further in the **Technical Specification 32 00 00 Erosion and Sedimentation Control**. During construction, the Contractor shall protect Site features (i.e., existing monitoring wells, security fence) as described in that Specification.

5.5.2 Site Traffic Management

Site vehicular traffic shall be managed by the Contractor in accordance with the **Contract Drawing C-3, General Site Plan.** As shown on the Contract Drawings, a vehicle decontamination pad and clean stone roadway shall be installed, with entry and exit via locked gates located along the western perimeter of the Site adjacent to Mill Street. All Site personnel, material and equipment deliveries shall utilize these gates for entrance and existing the Site. Decontamination procedures shall be followed in accordance with the Contractor's Health & Safety Plan and Equipment and Personnel Decontamination Plan.

5.5.3 Soil Excavations

Excavation areas shall be conducted in the areas designated on **Contract Drawing C-4, Remedial Excavation Plan**. Excavation depths are established based on previous investigation in-situ sampling (refer to **Appendices A** and **C** and the Tables in **Attachment 2**). The Engineer is responsible for marking out designated excavation areas and sensitive receptor areas (i.e., FEMA Floodway, 200-foot floodplain boundary, etc.). The Contractor and/or Engineer may utilize the survey control points as defined on **Contract Drawing C-5, Excavation Location Plan**. Monitoring wells within excavations and as delineated in **Contract Drawing C-3, General Site Plan,** will be either protected or closed in accordance with the technical specifications and RI regulations (i.e., by a RI licensed well driller of the Contractor's choosing, once approved by BASF). The list of wells to be closed or protected is presented on **Contract Drawing C-1**.

AEI (as resident engineer) will oversee the excavation activities and monitor the work for conformity with applicable plans, specifications and drawings. The Engineer will verify the final depths, as specified on the excavation plan using the survey grade stakes. A final as-built excavation plan, indicated final extents and depths, will be compiled as part of the final remedial close-out report. Soils excavated will be stockpiled in the stockpile staging areas as shown on **Contract Drawing C-3, General Site Plan**. Stockpiles will be covered at the end of each workday using two layers of 6-mil polyethylene sheeting and secured to prevent airborne dust emissions. Stockpile controls satisfying 40 CFR 761.65(c)(9) will be implemented by the Contractor as illustrated on **Contract Drawing D-1, Details 1**.

Concrete and/or asphalt covering PCB-contaminated soils which will be excavated will be assumed to have the same PCB concentrations as the underlying highest PCB concentrations in soils and will be removed and disposed along with the soils. AEI will test the concrete that is not in contact with >=10 mg/kg PCB impacted soils using the Standard Operating Procedure for Sampling Porous Surfaces for Polychlorinated Biphenyls (PCBs) [May 2011]. A minimum of three samples will be collected from each concrete area not in contact with >=10 mg/kg PCB-impacted soils prior to removal. The results of the testing will be provided to the Contractor. Concrete meeting the remedial standards set forth in the Contract specifications will be crushed by the Contractor to 3-inch minus and used as sub-grade backfill at a depth of at least one foot below the existing grade. Metal (uncontaminated or decontaminated) will be recycled at a licensed recycling facility. If the metal is located within a contaminated area, the metal must be decontaminated, and PCB wipe tested prior to recycling in accordance with 40 CFR 761.300.

Prior to backfilling, AEI will conduct post excavation sampling in accordance with **Section 4.2.1.8** and the SAP/QAPP (**Appendix F**). Backfilling operations will not commence until compliant soil sample results have been received for the excavation area.

Backfilling shall follow the plans and specifications. All backfill material in the Floodway shall meet the requirements of **Technical Specification 31 70 00 Analytical Testing Requirements for Imported Soil,** be free from deleterious material and meet the RIDEM Remediation Regulations for Imported Fill Material. A 6-inch layer of wetland topsoil shall be placed on top of imported material in the FEMA Floodway to support wetland plantings.

5.5.4 Waste Handling, Transportation and Disposal

Waste handling shall follow **Technical Specification Section 31 60 40 Handling, Hauling and Stockpile Management of Contaminated Soils**. All material hauling procedures shall be in accordance with the **Contract Drawings** and **Contractor Submitted H&S Plan.** Concrete and other debris shall be sized to meet the soil disposal requirements of the approved facility. Material stockpiled for loading and transport shall not remain on-Site for more than 180-days following generation, in accordance with TSCA (40 CFR 761.65(c)(9)). The Contractor is responsible for stockpile management and loading operations of materials into DOT approved trucks and/or containers. AEI will be responsible for obtaining transportation and waste manifesting prior to off-Site transport.

Water encountered during the soil remedy shall be managed by the Contractor. Water will be managed in accordance with the dewatering section (**Section 4.2.1.6**).

5.5.5 Clean Soil Covering

Covering the Site with clean soil is to commence following the soil excavation and backfilling operations described above. The area to receive the clean soil cover is shown on **Contract Drawing C-6, Clean Soil Cover Plan**. The plan indicates where areas are to receive a geotextile fabric (i.e., Mirafi 180N or equivalent) due to the presence of soils containing greater than or equal to 1 mg/kg PCBs and where areas are to receive an impermeable HDPE cover material (i.e., Nilex 40 mil HDPE, or equivalent) below the geotextile due to the presence of soils with PCBs >=10 mg/kg where no concrete slab is present to prevent leaching into groundwater. The Site-wide soil cover will consist of an 18-inch clean imported fill material with 6-inch topsoil layer (wetland topsoil in FEMA Floodway), unless otherwise specified by the final vegetative cover requirements. The final grading of the clean soil cover is shown on **Contract Drawing C-7**.

The Contractor shall utilize survey grade stakes to verify compliance with the 2-foot soil cover depth. AEI will oversee the covering operations and make periodic spot checks of the soil cover depth. Any deficiencies identified by AEI will be immediately fixed by the Contractor.

5.6 Shutdown

Soil excavation and clean soil cover installation activities will be completed when the non-compliant soils have been excavated and covered, as shown on **Contract Drawing C-6, Clean Soil Cover Plan** and described in the **Contract Specifications** (**Appendix E**).

A groundwater remedy operation, monitoring and maintenance plan, including closure metrics, will be prepared for regulatory approval under separate cover. In addition, after excavation, PCBs in groundwater will be monitored in MW-2S, MP-3S, and MP-3I at least on a semi-annual basis until PCB levels have demonstrated to achieve the 0.5 ppb cleanup level.

Formal closure submittals for the soil and groundwater remedies, will be submitted to EPA and RIDEM for approval. Regulatory approval shall signal substantial completion of the two remedies.

6.0 OPERATION AND MAINTENANCE

6.1 Clean Soil Cover Inspection and Maintenance

An annual clean soil cover inspection will be conducted on a calendar year basis in accordance with the ELUR. Maintenance, as needed or required by the Clean Soil Cover Management Plan (included as **Appendix J**) shall be conducted as soon as possible.

6.2 Sediment Monitoring

Given the historic remedial measures completed for sediment at the Site, a long-term periodic monitoring program will be implemented to ensure the existing sand cap remains intact and protective. Monitoring frequency is initially proposed to occur at the first five-year review (2022) and after major flood events between now and that time, defined by NOAA as a Pawtuxet River stage that exceeds 13 feet mean sea level (MSL) at the USGS gage station 01116500. Under the monitoring plan, the sand cap will be sampled for PCB content to ensure that any remaining PCBs sequestered below the cap are not permeating the cap. Cores of the cap will be collected along the center line at upstream, midstream and downstream locations (3 cores) and samples will be collected for PCB analysis from the 0" to 3" and 3" to 6" horizons (2 samples per core). In accordance with the draft SOB, if PCBs exceed 1 mg/kg in any sample, additional investigation will be conducted to determine the source of the detections and appropriate remedial measures necessary to ensure protectiveness, if any. A detailed monitoring and sampling plan will be developed following this outline. At the time of the 5-year review, based on the data in hand, a decision will be made as to the permanence of the remedy and future monitoring requirements.

6.3 ISCO Progress Monitoring

Details of the full-scale ozone ISCO application will be determined from the results of the pilot study. The details, which will include an operations, maintenance and monitoring plan, will be presented in a separate Groundwater CMI WP.

7.0 SCHEDULE AND REPORTING

7.1 Project Schedule

BASF is prepared to implement the final remedial design actions detailed in the previous Sections and as attached within the Final Design upon approval by EPA/RIDEM. Given the scope presented and pending approvals, the soil excavation portion of the project is expected to commence and be completed in Spring 2018, and clean soil cover installation close-out anticipated to be undertaken and completed in Summer 2018. Long-term monitoring of the clean soil cover, river sediment and progress monitoring of ozone/ISCO groundwater treatment programs are expected to extend beyond 2018. A proposed bar-chart type schedule is presented in **Table 2**.

7.2 Reporting

BASF will have its environmental consultant, AEI, on-site overseeing and documenting all site excavation, stockpiling, sampling, disposal, and site clean soil cover installation for the entire contract. The environmental consultant will report in writing monthly to the EPA/RIDEM-OWM the status and progress of the site work.

An Operating Log which clearly and completely records activities on-site and shows how the implementation and operation of the Remedial Action is progressing will be maintained at the site by AEI. This Operating Log shall include, at a minimum, the following information:

- Time periods of operation of the remedial unit and approximate excavation volumes;
- Records of any analyses conducted as part of the Remedial Action;
- Instances of implementation of the Contingency Plan; and
- An inspection plan designed to insure the proper operation of the proposed remedial unit. Operating treatment units shall be inspected at least monthly unless an alternative inspection frequency is approved by the Director.

Documentation of these inspections and any problems found and/or repairs made shall be included.

The Operating Log shall be readily available at the Contaminated-Site during implementation of the Final Remedial Design. The Operating Log shall be kept for at least three (3) years following completion of the Final Remedial Design.

7.2.1 Closure and Post-Closure Reporting

Remedial closure is expected in two phases: soil excavation/clean soil cover installation completion and groundwater ISCO/ozone treatment completion. Remedial objectives for soil shall be achieved when the proposed remedial measures and compliance sampling described in **Section 4.0** have been completed. A Corrective Measure Implementation Closure Report for the soil excavation and clean soil covering phase will be prepared by BASF and submitted to the EPA/RIDEM. The following elements will be included in the Closure Report:

- A description of the remedial measures completed, with as-built drawings of final site grades, utilities, excavated and backfilled areas, and monitoring well locations;
- Daily reports recording work undertaken, issues resolved, health and safety information, and changes, if any, in Contract Documents:
- Tables summarizing the compliance sampling laboratory analytical data;
- A plan showing the compliance sampling locations;
- Copies of the compliance sample laboratory analytical data;
- Copies of waste disposal and/or imported soil documents; and
- Photographs of progress and completion phases of work.

A groundwater remedial closure report will be prepared by BASF and submitted to EPA/RIDEM under separate cover and will include similar documentation as mentioned above.

8.0 REFERENCES

AECOM, 2016a, "Final Corrective Measures Study, BASF Corporation, Former Ciba-Geigy Facility, 180 Mill Street, Cranston, Rhode Island", Submitted June 20, 2014; Revised September 21, 2015; Final Submittal April 29, 2016.

AECOM, 2016b, "Supplemental Remedial Investigation Report (Revised), Former Ciba-Geigy Facility, Cranston, Rhode Island", Submitted November 2012; Revised June 2014; Final Submittal April 2016.

AEI, 2017a, "Memorandum: Cranston RCRA Closure Project: Former Product Area Remediation", July 13, 2017.

AEI, 2017b, "Memorandum: BASF Corporation – 180 Mill Street Cranston Rhode Island Facility, Test Pitting Results", May 12, 2017.

AEI, 2017c, "Memorandum: BASF Corporation – 180 Mill Street Cranston Rhode Island Facility, Lot 1102, Groundwater Sampling", May 18, 2017.

AEI, 2017d, "Remedial Action Closure Report", March 1, 2017, Addended August 29, 2017.

Ciba Corporation, 1995, "RCRA Facility Investigation Report, On-Site Areas, Former CIBA Site, Cranston, Rhode Island, Volume 1: Chapters 1-7. July 31, 1995.

EPA, 2016, Draft Statement of Basis, https://semspub.epa.gov/src/collection/01/AR64497.

PTRL Environmental Services, 1996, "Aquatic Baseline Ecological Risk Assessment for the Ciba-Geigy Site at Cranston Rhode Island", March 28, 1996.

Woodward-Clyde, 1996, "Revised On-Site Soil Interim Remedial Measures Report", August 6, 1996.

RIDEM, 1993, "DEM-DSR-01-93: Rules and Regulations for the Investigation and Remediation of Hazardous Material Releases (Remediation Regulations)", Amended November 2011.

USEPA, 2011, "Corrective Measures Implementation (CMI) Scope of Work," July 14, 2011.

9.0 CERTIFICATION STATEMENTS

Statement of Certification by the CMI Plan Preparer

I prepared this CMI Plan and certify the information contained in the CMI Plan is accurate to the best of my knowledge.

Steven P. Cadorette, P.E., Senior Civil Engineer
Gordon R. Archibald, Inc.
200 Main Street
Pawtucket, Rhode Island 02860

Statement of Certification by the Performing Party Authorized Representative

I certify that this CMI Plan is a complete and accurate representation of the contaminated-site and the release and contains all known facts surrounding the release to the best of my knowledge.

Joseph Guarnaccia, Ph. D., EHS Remediation Specialist
BASF Corporation
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Florham Park, New Jersey 07932